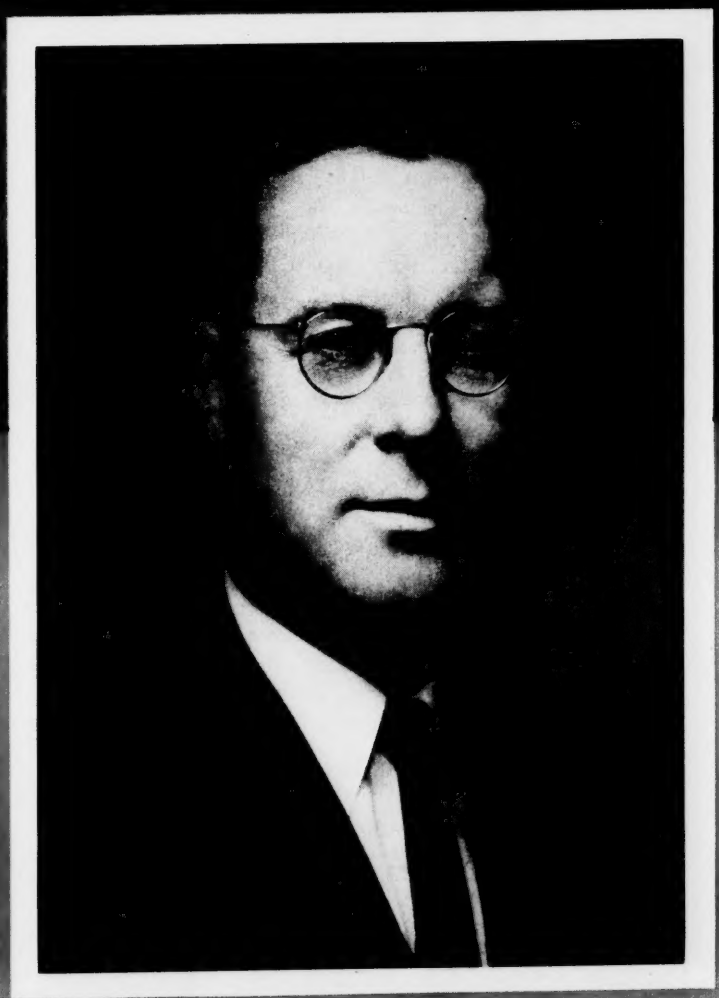
Metals Review



November 1958

A. J. Phillips
1958 Gold Medal
(See Article, p. 5)

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Reviews Newer Metals

Robert Hendricks (Left), Technical Chairman, Is Shown With D. J. McPherson, Armour Research Foundation, Who Spoke on "Potentials and Problems of the Newer Metals" at a Meeting of the Fort Wayne Chapter

Speaks at Oak Ridge

H. B. Hurt, Clinical Psychologist, Oak Ridge National Laboratory. Spoke on the "Metallurgist and His Family" at Oak Ridge. Shown, from left, are: W. S. Dritt, chairman; Dr. Hurt; and W. O. Harms

Speaker: Donald J. McPherson
Armour Research Foundation

At a meeting of the **Fort Wayne Chapter,** D. J. McPherson, manager, metals research department, Armour Research Foundation, spoke on the "Potentials and Problems of the Newer Metals". His talk was confined to metals which have been known for some time but which now show promise of becoming structural metals. In general, these metals have lightness, heat resistance or special nuclear properties to their advantage.

Dr. McPherson discussed eleven such metals: beryllium, titanium, vanadium, chromium, zirconium, columbium, molybdenum, hafnium, tantalum, tungsten and rhenium. Of these, only hafnium and rhenium have marginal availability and therefore, probably should not be considered as structural materials. The others have advantages over some of the presently used materials by virtue of: light weight and moderate heat resistance (Be, Ti, V, Zr); heat resistance—1800° F. or higher (V, Cr, Cb, Mo, Ta, W); or nuclear structure (Be, Zr, Cb, V).

These metals all have production fabrication characteristics which must be overcome to make them more readily useful. Nearly all of them are reactive with air or gases at high temperature (Ti, V, Zr, Cb, Mo, Ta, W) while some of them (Be, Cr, Mo, W) may be quite brittle at room temperature.

The following highlights from the discussion of the individual metals are worthy of note:

Beryllium. Has low neutron capture cross-section, a density about equal to magnesium and one-half of aluminum, a much higher melting point than Al or Mg (2340° F.), a very high modulus of elasticity (44 x 10^6 at 70° F. and 26 x 10^6 at 1200° F.), retains much of its strength up to 1000° F. Disadvantages are brittleness at room temperature and toxicity. The brittleness characteristic can probably be corrected by special thermal and/or fabrication techniques.

Titanium. Many advances have been made with this metal and currently there are about 12 alloys available which are structurally useful. New markets and cost reduction (in mill processing) must be developed for this metal to fulfill its destiny. Three new heat treatable alloys are now being tested and these may revive the interest of the aircraft industry in titanium.

Vanadium. Has properties which could make it competitive to stainless steel and titanium in aircraft applications. Vanadium melts at 3450° F., has a density midway between titanium and steel, has better creep properties between 1000 to 1200° F. than titanium or stainless and can be used up to 1700°F. if nickel plated. It is limited because it is very reactive above 1250°F., is not strong at room temperature (but retains its strength up to high temperatures) and is quite expensive.

Chromium. Has excellent oxidation resistance and load-carrying ability at high temperatures and is one of our best hopes of extending the high-temperature range of superalloys. Brittleness at room temperature is the most serious objection to its use. This problem may be overcome through research into the melting and working procedures.

Zirconium. Has very good corrosion resistance and has gained wide acceptance in boiling water reactor use. Alloys have been developed which are equivalent in strength to Type 347 stainless at 1500°F. Due to its reactive characteristics it is processed the same as titanium, therefore, to lower its price and make it competitive, the processing costs must be lowered.

Columbium. Has a very high melting point, resists corrosion of many liquid metals and is plentiful in the United States. Its use is limited by poor oxidation resistance, high cost and poor elastic properties. Overcoming some of these limitations may lead to development of alloys useful at temperatures beyond 2000°F.

Molybdenum. Has a high melting point, high modulus of elasticity, high thermal conductivity, low coefficient of expansion, and is very strong at high temperatures. Disadvantages are high density, tendency to brittleness and highly reactive nature. Melting and processing techniques may be developed which will eliminate some of these disadvantages. A recrystallization temperature between 2400 and 2700° F. may make it useful to this temperature range. Protective coatings must be developed.

Tantalum. Hope for this metal being a structural material is based only on its high melting point and recrystallization temperature between 2600 and 2700°F. It has a density twice that of steel and high neutron capture cross-section which means it must be kept out of atomic reactors. Not much work has been done with this metal but it is very reactive in oxygen which indicates the need for some type of coating for protection.

Tungsten. Melts above 6000°F., recrystallizes about 2700°F. and has high density. Very little work has been done with it but it holds the highest hopes for high-temperature service. Brittleness and reactive nature are the most important problems to be solved. It oxidizes catastrophically like molybdenum and, therefore, will probably require a coating system.

Dr. McPherson stated that development of these metals is essential for us to extend upward the operating temperature range necessary in many applications such as high-speed aircraft and space travel.—**Reported by N. L. McClymonds for Fort Wayne Chapter.**

A. J. Phillips Receives A. S. M.'s Gold Medal

Albert J. Phillips, vice-president and director of research, American Smelting and Refining Co., South Plainfield, N. J., was selected by the American Society for Metals as the recipient of its Gold Medal for 1958 for his "productive and distinguished career as a metal scientist, an inspiring leader and an able administrator". Dr. Phillips received the award at the Society's annual banquet, held Oct. 30 in Cleveland in conjunction with the 40th National Metal Congress and Exposition.

The Gold Medal of the A.S.M. is awarded annually in recognition of "outstanding metallurgical knowledge and great versatility in the application of science to the metal industry". It was established in 1943 and has been presented to such illustrious metal scientists as Zay Jeffries, Earle C. Smith, Paul D. Merica, R. F. Mehl and John Chipman.

Dr. Phillips graduated from Yale University in 1923 and received the first Ph.D. in metallurgy ever presented by Yale in 1928. From 1925 until 1931 he was connected with the Scoville Manufacturing Co. He then transferred to the American Smelting and Refining Co., where he has won wide respect in the field of nonferrous metals. He became a vice-president of the company in 1953.

Dr. Phillips is probably best known for his work in continuous casting and the Asarco process which was first applied to casting of bronze and silver rods, tubes and shapes.

His services to the U. S. Government include membership on the Advisory Committee on Metals and Minerals of the National Research Council during World War II and on successor committees, including the present Materials Advisory Board. Dr. Phillips visited Europe in 1945 on a technical survey under the auspices of the Technical Industrial Intelligence Commission. He was chairman of the Panel on Metals and Minerals of the Research and Development Board from 1951 to 1954, and served on the A.E.C. Pyrometallurgical Processing Committee in 1952, the Titanium Advisory Committee from 1954 to 1958, and he is currently on the Technical Advisory Committee to the Metallurgy Division of the National Bureau of Standards. He is a member of numerous metallurgical and scientific societies here and in Great Britain.

Compliments

To LOUIS H. WINKLER, metallurgical engineer, Bethlehem Steel Co., on his retirement after 40 years of service with the company and companies which later became part of Bethlehem. Mr. Winkler has served on the A.S.M. Metals Handbook Committee since 1951.

♦ ♦ ♦

To EDGAR H. DIX, JR., assistant director of research since 1952 for Aluminum Co. of America, on his retirement after 35 years of service in various sections of the company. Mr. Dix was the Edward deMille Campbell lecturer for A.S.M. in 1949 and received the Albert Sauveur Achievement Award in 1956 for his "outstanding work in aluminum alloy research".

♦ ♦ ♦

To ALFRED SEEGER, on being appointed to a Professional Chair in Metal Physics by New York University's College of Engineering.

♦ ♦ ♦

To PAUL GORDON, who has been promoted to the rank of full professor in the department of metallurgical engineering, Illinois Institute of Technology. Dr. Gordon was formerly on the faculty of the Institute for the Study of Metals, University of Chicago, and previously was in charge of physical metallurgy for the A.E.C. at Massachusetts Institute of Technology.

♦ ♦ ♦

To DEREK RICHARDSON, on his appointment to vice-president of aluminum sales, Olin Mathieson Chemical Corp.

♦ ♦ ♦

To GEORGE S. CRAMPTON, professor emeritus of ophthalmology at the University of Pennsylvania Medical School, who received the Edward Longstreth Medal from The Franklin Institute for his development of the borescope, a specialized periscope for the internal inspection of turbine shafts and various closed vessels.

♦ ♦ ♦

To R. J. PERRINE, Electric Furnace Co., and RICHARD A. SMUCKER, E. W. Bliss Co., who have been awarded the Fifth Annual Pressed Steel Award jointly by the Pressed Metal Institute for their work in developing methods and equipment to roll high-quality strip from copper, nickel and other metal powder.

♦ ♦ ♦

To EARLE C. SMITH, chief metallurgist and director of research, Republic Steel Corp., who received an honorary degree of doctor of science from Ohio State University. Mr. Smith received the Gold Medal of A.S.M. in 1945.

Economics of Space Age Reviewed at Pennsylvania

Speaker: W. H. Steurer
Army Ballistic Missile Agency

The Northeast Pennsylvania Chapter heard Wolfgang H. Steurer, in charge of material research at Redstone Arsenal in the Army Ballistic Missile Agency, present "A Metallurgist's View of Our Rocket Development".

The technical subject was introduced by a movie on guided missiles, followed by a review of the development of rockets and guided missiles. The development of large-scale rockets during World War II was discussed, with emphasis on the establishment of engineering criteria and material requirements.

Rockets, satellites and space ships are not just another achievement of engineering. They may introduce a new era of history, with serious effects on engineering as well as our economy. From the viewpoint of the metallurgist, there are new requirements, resulting from unprecedented operational as well as environmental conditions. New materials have to be found for the extremely high temperatures encountered in high-speed flight within the atmosphere. During the re-entry maneuver of the long-range ballistic missiles, these temperatures may reach degrees which no material, metallic or nonmetallic, can resist. Yet, the extremely short times involved permit new concepts, wherein materials assume a functional role in the absorption of heat. In outer space, unusual and even partly unexplored environmental conditions are encountered. Materials will have to withstand the effects of an almost perfect vacuum, of meteorites and cosmic dust, or the effect of solar and cosmic radiation.

The further we reach into space, the smaller will be the number of vehicles built, each representing tremendous financial investments. This may introduce a new philosophy in materials production, where quality replaces quantity, which may greatly affect our over-all economic system. Yet, new concepts in science and engineering, as well as in economy, have to be adopted if we expect to lead in the conquest of space.—**Reported by R. L. Ward for Northeast Pennsylvania.**

Richmond Talk Is on Russia

Members of the **Richmond Chapter** heard a talk on "Russian Metallurgy" by N. J. Grant, metallurgy department, Massachusetts Institute of Technology, at their last meeting of the 1957-58 season. There were 23 members and 75 guests present at the meeting, to which members of other local technical societies had been invited.

Quarterly preprint list

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The following papers will be preprinted for distribution to members of the American Society for Metals upon request. Order the papers by their numbers.

The eight papers herewith listed represent the 1958 fourth quarterly preprinting of papers accepted by the Transactions Committee for inclusion in the annual volume of the Transactions of the Society. A brief abstract of each paper in included.

117. Activation Energies for Creep of an Alpha Solid Solution of Magnesium in Aluminum, by N. R. Borch, L. A. Shepard and J. E. Dorn, Dept. of Engineering, Institute of Engineering Research, University of California, Berkeley.

The activation energies for creep of an Al-3.2% Mg alloy were studied over a temperature range from 78° K. to the melting point. With the exception of a temperature region from 200 to 380° K., where locking effects and periodic yielding were observed, the activation energies for the alloy are the same as those previously reported for pure Al. However, an activation energy peak greater than 80,000 cal/mole was obtained at 325° K. and creep became immeasurably slow.

The activation energy peak is analyzed in terms of Cottrell's mechanism for strain aging and solute atom locking, with the further postulate that locking occurs while the dislocation is arrested at a barrier. Strong evidence is presented to suggest that at the temperature of the peak, dislocation motion must be largely athermally produced. Both the Portevin-Le Chatilier effect and delayed yielding are discussed in terms of athermal unlocking of dislocations.

118. Influence of Static Stress and Temperature on Internal Damping, by J. W. Clark and W. C. Hagel, Metallurgical Development, Measurements Laboratory, General Electric Co., West Lynn, Mass.

The internal damping of fixed-fixed beam AISI-403, Ti and ferromagnetic austenitic alloys was measured at vibratory stresses from 0 to 35,000 psi. at static tension stresses from 0 to 19,000 psi. in the temperature range of 75 to 1100° F.

Under a static stress of 19,000 psi., the damping of AISI-403 observed at 500 to 700° F. is reduced by more than an order of magnitude from that measured at zero static stress at 75° F. Ti shows very low internal damping under all test conditions. Although the damping of ferromagnetic austenitic alloys decreases less rapidly with increasing temperature than it does in the case of AISI-403, the influence of static stress or magnetic fields causes a more drastic reduction.

119. Development of a Ferromagnetic Cobalt-Base High-Temperature Alloy, by A. Cochardt, Advisory Engineer, Metallurgy Dept., Research Laboratories, Westinghouse Electric Corp., Pittsburgh, Pa.

A number of alloys precipitation-hardened with Ti and containing 62 to 88% Co were made in an effort to develop a new blade material for turbines and compressors. The damping behavior, aging characteristics, creep and fatigue properties and oxidation resistance of these alloys were tested. It was found that some alloys exhibit similar strength and damping at 1200° F. as alloy AISI-403, the present blade material in steam turbines, at 900 to 1000° F. The optimum composition range of these alloys is 22 to 24% Ni, 1.8 to 2.0% Ti, 0.15 to 0.25% Al and the balance Co. The damping capacities of these alloys are ten times higher at vibrational tensile stresses of 8000 psi. than those of similar nonferromagnetic alloys. At 1200° F. the 100-hr. rupture stress is of the order of 50,000 psi. and the endurance limit of the order of 40,000 psi. The oxidation resistance is greatly improved by small additions of Si and Cr.

120. Metallography of Uranium, by R. F. Dickerson, Chief, Reactor Metallurgy Division, Battelle Memorial Institute, Columbus, Ohio.

The various allotropic transformations occurring in uranium and crystallography of these phases, with some mention of common heat treating temperatures and recrystallization temperatures described.

Conventional preparatory techniques, including mechanical and electrolytic polishing methods, etching techniques and the use of polarized light for the delineation of structure. Nonconventional techniques, such as vacuum-cathodic etching, anodic oxidation, hot stage microscopy and strain etching are described and evaluated.

The five so-called basic metallographic structures of uranium are alpha annealed, alpha-transformed-beta quenched, alpha-transformed-beta slow cooled, alpha-transformed-gamma quenched, and alpha-transformed-gamma slow cooled. Limited mention of certain peculiarities in the structures, such as the ghost or subgrains which are quite common in the alpha-transformed-beta structures. In conjunction with the discussion of structure, the techniques used to determine the grain size of uranium in different conditions of heat treatment are described. A modification of the Jeffries' method is commonly used for all structures but the alpha-transformed-beta structures. The determination of grain size in the alpha-transformed-beta structures is difficult but a specially developed macro technique is slowly being accepted for this purpose. Paper is concluded with discussion of nonmetallic inclusions in uranium.

121. Fatigue Properties of High-Strength Steels, by H. E. Frankel, J. A. Bennett and W. A. Pennington, U. S. Dept. of Commerce, National Bureau of Standards, Washington, D. C.

A study was made of the influence of a number of metallurgical variables on the fatigue properties of high-strength steels. The rotating beam fatigue strengths of four steels with carbon contents ranging from 0.44 to 1.06% were determined for a number of quenched and tempered conditions. All specimens were heat treated after final finishing to avoid changes in the structure at the surface that might obscure the effects of the variables being investigated.

As the fatigue strength was a nearly linear function of hardness up to some limiting value, it was possible to adjust the data to a single hardness value to deter-

(Continued on next page)

Los Angeles Executive Committee Meets

Members of the Executive Committee Formed by the Los Angeles Chapter Include, From Left: R. E. Huffaker, John E. Wilson, H. A. Messner, C. H. Dickson, R. H. Gassner, Edward Egloff, H. A. Curwen, Stuart K. Oliver, Chairman, W. V. Ward, K. L. Clark, F. W. Golda, E. C. Buckingham, P. Crippen and J. Goodwin

Covers Corrosion Problems At Wilmington Meeting

Speaker: M. G. Fontana
Ohio State University

Mars G. Fontana, chairman, department of metallurgical engineering, Ohio State University, discussed "Unusual Corrosion Problems" at a meeting in **Wilmington.**

Following his preliminary remarks about corrosion, Dr. Fontana proceeded, with the aid of color slides, to illustrate various types of corrosion, the nature of each and the reasons why corrosion had caused failure of the parts involved. Especially interesting were the slides showing corrosion on surfaces of equipment which was not considered liable to attack in its design and construction. Stress was laid on the role of the materials engineer and the important task of the fabricator in assembling the equipment.

Corrosion problems in tropical climates where corrosion rates are speeded up and corrosion is a never-ending problem to industry require time, effort and money to combat or else the equipment is left to the mercy of the elements.

In discussing off-shore drilling platforms, much can be done in the way of preventive maintenance by the use of corrosion inhibitors or cathodic protection. — **Reported by Liston Noble, Jr., for Wilmington.**

ASM Appoints Accountant

Appointment of Burleson D. White as senior accountant of the American Society for Metals has been announced by Ray T. Bayless, assistant secretary.

Mr. White, who comes to the A.S.M. after four years service with Ernst & Ernst, accountants, where he was a member of the auditing staff, will work with Alfred A. Hess, assistant treasurer of the Society, in all matters pertaining to the Society accounting.

Burley was graduated from Colorado College in business administration in 1951. He is married and has two children, and served for three years in the Marine Corps.

---

mine the effect of other variables. There was no significant difference between marquenched specimens and those that were direct quenched. It was found that fatigue strength was lowered by increasing amounts of retained austenite up to about 10%. This deleterious effect was apparently due to transformation of some of the austenite which was observed to take place during fatigue stressing.

122. Effect of Cooling Rate From Ms Temperature to Room Temperature on Magnetic Properties of 3.5% Chromium Magnet Steel, by W. L. Hodapp, Metallurgical Laboratory, Sanderson - Halcomb Works, Crucible Steel Co. of America, Syracuse, N. Y., and E. A. Loria, Central Metallurgical Office, Crucible Steel Co. of America, Pittsburgh, Pa.

The magnetic properties of 3.5% Cr magnet steel were determined from specimens which were subjected to various cooling rate treatments. These included water, oil, air and furnace quenching from 500° F. to introduce a variety of successively slower cooling rates. The same data were obtained for the quenched bars after cumulative stabilizing treatments of aging at 212° F. and cooling in dry ice. The results of magnetic tests show that the effect of the alteration of cooling rate from 500° F. to room temperature is associated with retained austenite. The most rapid rate of cooling (water) produces the least amount of retained austenite, while the slowest rate (furnace) results in the greatest amount of retained austenite according to X-ray determinations. Cumulative applications of stabilizing treatments produce appreciable changes in magnetic properties for specimens subjected to the slowest cooling rate from 500° F. to room temperature, whereas negligible changes in magnetic properties occur in the case of the most rapid quench.

123. Constitution Studies of the Antimony and Bismuth-Rich Portions of the Sb-Bi-In System, by E. A. Peretti, Head, Dept. of Metallurgy, University of Notre Dame, Notre Dame, Ind.

The system has been investigated by thermal analysis, microscopic and X-ray methods. Of the three possibilities only the InSb-InBi isopleth is a true quasi-binary.

A eutectic valley runs from the InSb-Sb binary eutectic (494° C.) to a point whose composition and melting point approach that of Bi (271° C.)

Alpha, having the Sb and Bi crystal structure, is the primary phase to precipitate for alloys in the Sb side of the eutectic valley. Beta, with the crystal lattice of InSb, crystallizes first from alloys lying in the InBi side of the valley.

Solid alloys consist of alpha plus beta or alpha, beta and gamma, depending upon composition.

124. Textures in Extruded Uranium, by R. B. Russell, Nuclear Metals, Inc., Cambridge, Mass.

The preferred orientation or texture of alpha-extruded, cold swaged, recrystallized, and beta-quenched uranium has been determined. Attempt is made to predict the mean thermal expansion coefficients from the texture and principal crystallographic thermal expansion coefficients.

Discusses Brittle Fracture

W. S. Pellini (Right), U. S. Naval Research Laboratory, Who Presented a Talk on "Brittle Fracture of Weldments" at a Meeting in Detroit, Is Shown With Richard A. Flinn, Technical Chairman of the Meeting

Speaker: W. S. Pellini

U. S. Naval Research Laboratory

W. S. Pellini, superintendent, metallurgy division, U. S. Naval Research Laboratory, spoke before the **Detroit Chapter** on "Brittle Fracture of Weldments—Causes and Prevention". He described cases of sudden catastrophic failures of large welded steel structures such as ships, storage tanks and pressure vessels. Indications of the seriousness of this problem were first evident in the collapse of welded bridges in Belgium during the late 1930's and the collapse of large storage tanks in this country. During the early years of World War II, a high failure rate of the new all-welded merchant ships was experienced, a situation which demanded an all-out effort by designers, welding engineers and metallurgists to determine the cause and to establish solutions or remedial procedures.

The speaker gave a chronological account of developments from 1942 to the present. The mid-40's was a period marked by investigations of the Charpy V characteristics of failure material which may be described as the search for a correlation between small laboratory notch tests and service experience. This work demonstrated that brittle fractures were initiated only at temperatures such that the Charpy V tests indicated values of less than 10 ft-lb. Since then it has been established, by further correlations with service failures, that for certain classes of steels the critical correlation values are in the order of 15 to 30 ft-lb.

Another approach was to test large pieces of steel containing notches of various types to reproduce the failure conditions at the temperatures of failures in service. This approach was not fruitful until very sharp cracks were placed in the test plates. Work with brittle weld crack starting tests established the existence of a critical temperature, termed the nil-ductility temperature, below which the steel could be described as unable to deform in the presence of a sharp crack. This temperature was shown to be in correct correspondence with the failure temperatures of the ship steels and a wide variety of nonship failures, such as pressure vessels. The sharp crack approach was further exploited successfully in the Robertson test (England) and the S.O.D. test (U.S.A.). These tests were successful in predicting crack stopping temperatures; that is, temperatures above which the fractures could not propagate in material stressed within the elastic range.

The results of these investigations have been fitted into a general scheme which defines the role of design, welding and materials in the problem of brittle fracture. Temperature, as a new parameter of design, must be recognized as basic to this problem. The lesson on the wartime ships—that a design which is safe for operation of the ship at summer temperatures may be unsafe for winter temperature operation—must be accepted as a guide in the future if the steels show a notch ductile-to-brittle transition in this temperature range. The designer should thus be concerned with questions of the notch ductile-to-brittle transition characteristics of steels as related to the expected service temperature range.

The role of the metallurgist is now clear; the properties of the steels must be modified (within certain restrictions of economics) so that the notch ductile-to-brittle transition is below that of the expected service temperature. If the metallurgist succeeds, the designer's task is greatly simplified; conventional design concepts may be applied with safety. If steels of adequate notch ductility are not available, great attention to design details is mandatory in order to lower the *probability* of failure to acceptable levels. The significance of the ductile-to-brittle transition temperature range is that above this range the probability of brittle fracture is removed, while below this range the probability is always finite.

The role of welding is now clear also although less definable than in the case of metallurgy. Welding may contribute notches, cracks or other flaws from a variety of causes. The presence of such notches or flaws at points of high stresses in steel of inadequate notch ductility is the combination which leads to brittle fracture problem.—**Reported by R. Amala for Detroit.**

Illustrates Testing Methods

Samuel Zarcoff (Left), Curtiss Wright Aeronautical Division, Who Spoke on "Nondestructive Testing—Its Present and Future" at a Meeting Held in Jackson, Is Shown With C. R. St. John, Chairman of the Chapter

Speaker: Samuel Zarcoff

Curtiss Wright Corp.

Samuel Zarcoff, senior metallurgist, Curtiss Wright Aeronautical Division, spoke on "Nondestructive Testing, Its Present and Future" at a meeting of the **Jackson Chapter.**

He defined modern nondestructive tests such as ultrasound, audiosound, thermo-electric, tribo-electric, magnetic induction, eddy-current, electrostatic, X-ray and beta rays, pointing out the advantages and applications of each method.

Mr. Zarcoff stressed the importance of correlating test data and explained how this data should be used. He illustrated, with slides, a wide range of equipment and its specific uses, ranging from measuring of nickel plate depth, gear teeth hardness to internal defects on small and large parts.

Mr. Zarcoff predicted that sometime in the future a nondestructive test instrument capable of measuring dimensions, analysis, hardness, service life, etc., might be linked back to the manufacturing operation in a closed loop that could signal each operation to make corrections. Nondestructive test instruments coupled with decision circuits represent the extreme point in the use of this equipment. The sensory organs of the future fully automatic factory will be the nondestructive test instruments.—**Reported by W. F. Stewart for Jackson.**

OBITUARIES

V. A. CROSBY, manager of automotive development, Climax Molybdenum Co., died on Oct. 2. Mr. Crosby was a member of the Detroit Chapter.

♦ ♦ ♦

J. L. (Lans) MCCLOUD died July 26 of a heart attack while playing golf. A long-time member of Ford Motor Co.'s metallurgical, chemical and manufacturing engineering staffs, he retired in mid-1956 and moved to Los Altos, Calif. He was active in the Detroit Chapter for many years. Since his retirement he served with distinction as consulting editor for *Metal Progress*.

♦ ♦ ♦

F. A. MCCOY, a member of the Kansas City Chapter, died in August after an illness of about one year. Mr. McCoy had been works metallurgist at the Sheffield Division, Armco Steel Corp. since 1950. He was one of the founders of the Kansas City Chapter, which honored him in 1956 with a bronze plaque.

♦ ♦ ♦

EDWARD A. COWLES, a founder and president for 37 years of Cowles Tool Co., until his retirement in 1954, died in Cleveland in August at age 88.

♦ ♦ ♦

REUBEN MACCOURT, executive vice-president and general manager of Achorn Steel Co., died in September. He was 67. Mr. MacCourt had been with the company for 33 years.

♦ ♦ ♦

LLOYD A. BALDWIN, proprietor of the Baldwin Welding Works, died late in June at the age of 61. He specialized in joining difficult-to-weld materials and was well known in the East for his ability in this field. He was a member of the New Jersey Chapter.

♦ ♦ ♦

MANOEL F. DE MAYO BEHAR, retired vice-president of Instruments Publishing Co. and editor emeritus of *Instruments & Automation*, died in August at the age of 69.

♦ ♦ ♦

JAMES OSBORN LORD, 66, professor of metallurgical engineering, Ohio State University, died in October after suffering a heart attack. A 1915 graduate of Ohio State, he was the first dean of the College of Engineering there. He was chairman of the Columbus Chapter in 1931-32.

♦ ♦ ♦

JAMES S. FREESE, general production manager, Timken Roller Bearing Co., died in October after an illness of several months. Mr. Freese started with Timken in 1929.

A. S. M. has produced and makes available for showing before chapters and educational institutions moving picture films pertaining to metals.

Patent System Explained at Chattanooga

Shown at a Meeting of the Chattanooga Chapter Are, From Left: John W. Buskie, Program Chairman; Joseph C. Lange, Engineer of Patents, Crane Co., Who Spoke on "Patents"; and John Pikciunas, Then Chairman of the Chapter

Speaker: Joseph C. Lange
Crane Co.

Members of the **Chattanooga Chapter** heard a talk on "Patents" by Joseph C. Lange, engineer of patents, Crane Co.

The speaker traced the history of patents back to the thirteenth and fourteenth centuries in England when the Guilds received monetary awards and other forms of recognition from the Crown for outstanding accomplishments and discoveries. Such a system led to favoritism, and Parliament took steps to take the right of awarding such prizes from the Crown. In 1623, with the passage of "The Statute Against Monopoly", patents were awarded to applicants by Parliament.

Our own Constitutional Convention debated what form of awards should be given for discoveries, and wrote into the Constitution provision for a patent system, by which inventors should be given exclusive rights to their inventions for a definite length of time.

The speaker brought out that the patent system is largely responsible for our country's progress in that it promotes the sciences by awarding individuals and promotes business by making possible the safe investment of money by companies in ideas protected by patents.

Since each of us is a potential inventor, the speaker made some suggestions about protecting our future chances for a patent. The idea or conception of a problem solution—the invention—should be followed by a reduction to a record with dates, drawings, witnesses, and all facts necessary to prove that you had the idea first and made it work. In the field of metallurgy, chemical analysis, apparatus, heat treatment and application are important items in this reduction of the idea to a patent.

Once the patent application is filed, and the speaker explained the role of a patent attorney with his knowledge of the technical language of patent descriptions in preparing the application, the patent office examines the application to determine if it is worthy of a patent and to determine whether or not it would infringe upon another person's patent.

Mr. Lange stated that patents are granted to promote the public welfare and are a contribution to the public good, and although we might find cases of what seems to be mistakes in the granting of patents, the system as a whole is based on the fundamental idea of awarding contributions to the public good.—**Reported by J. H. McMinn for Chattanooga Chapter.**

ASM Adds New Chapter

A new chapter of the American Society for Metals, to be known as the Southeast Ohio Chapter, has received its charter and elected officers. The first formal meeting of the Chapter featured C. H. Lorig, A.S.M. vice-president and president-elect, as guest speaker.

The newly elected chairman, A. F. Sprankle, Vanadium Corp. of America, stated that the need had become apparent for a chapter because of the growth of metallurgical activity in the area and the need for a medium of exchange of metallurgical information to develop and hold the interest of young metallurgists and technicians.

Officers of the new chapter, besides Mr. Sprankle. are T. W. Merrill, vice-chairman, H. W. Rathmann, secretary, both from Vanadium Corp. of America, and S. J. Vellenga, treasurer, from Muskingum College.

Gives Talk on Oxidation and Scaling

"Oxidation and Scaling" Was the Subject Discussed by W. M. Baldwin, Jr., Case Institute of Technology, at a Meeting of Chicago-Western Chapter. Shown are, from left: E. J. Ripling, technical chairman; Dr. Baldwin; Carl E. Swartz, then a national trustee; and J. F. Shumar, chairman

Speaker: W. M. Baldwin, Jr.
Case Institute of Technology

"Oxidation and Scaling" was the topic of the talk presented to the members of the **Chicago-Western Chapter** by W. M. Baldwin, Jr., research professor of metallurgical engineering, Case Institute of Technology.

Basically, scaling is a chemical reaction between a metal and a gaseous nonmetal component. Consequently the law of mass action applies and from it the dissociation pressures of the scale can be ascertained at any one temperature. It may be defined as that pressure of the reacting gas which is in equilibrium with the oxide. A metal or alloy will oxidize if its dissociation pressure is lower than the partial pressure of the attacking gas in the ambient atmosphere. Another way to tell if a metal or alloy will oxidize is from constitution diagrams which illustrate the oxides which are possible under thermodynamic equilibrium conditions at any one temperature; however, their actual appearance depends on the kinetics of formation. In the case of thin films of the order of 100-1000Å the atomic forces are so strong that the film may conform to the substrate and form a pseudomorphic oxide.

Let us assume that a metal or alloy will oxidize; then the next point of interest is the ability of the scale formed on the metal to seal off further reaction. If the volume of the oxide is larger than that of the metallic substrate in question then the oxide is in biaxial tension and this condition results in failure and cracking of the scale with no protection on further scaling. This situation leads to a linear scaling law.

On the other hand, if the volume of the oxide is larger than that of the metal then the scale is under biaxial compression and it will probably be compact and offer a coherent surface barrier. When this condition prevails the rate of further oxygen pick-up is inversely proportional to the existing oxide thickness (i.e., scaling proceeds according to the Pilling and Bedworth parabolic law).

In general, it is usually possible to predict what type of scale a metal will have. Thus light metals such as magnesium and calcium form fluffy nonprotective scales whereas the heavy metals form coherent protective scales.

The scaling constant K is a function of the transport numbers, conductivity, etc. Thus, if a metal has an oxide with a very low conductivity, it should scale slowly provided the scale is compact.

Dr. Baldwin reviewed the scaling behavior of a number of metals with particular reference to the unexplainable behavior of titanium, zirconium and lead. These metals exhibit a change in scaling rate after a definite time. The scaling behavior of zirconium is further complicated by the lateral growth which it undergoes during scaling in air and also in oxygen after appreciably longer times. The scaling behavior of alloys is much more complex in that one or both metals may oxidize.

If one considers the case in which the solute metal scales and oxygen is soluble in the base metal, then a deep subscale, a shallow subscale heavy with precipitated oxide, or an outer scale may result, depending on the concentration of the solute, its diffusivity, and the diffusivity of oxygen. There is a threshold solute concentration at which the transition from subscale to outer scale occurs.

In closing, Dr. Baldwin stated that the scaling of pure metals except titanium, zirconium and lead is well understood; however, in the case of the alloys only a few systems have been studied and consequently no generalizations can be made. We still cannot predict what concentration of a solute metal must be added to an alloy system to form a protective scale.—**Reported by D. J. Garibotti for Chicago-Western.**

Technical Papers Invited for A.S.M. Transactions

The Transactions Committee of the A.S.M. is now receiving technical papers for consideration for publication in the Transactions of the Society and possible presentation before the next national meeting of the Society, to be held in Chicago, Nov. 2 to 6, 1959.

Many of the papers approved by the Committee will be scheduled for presentation on the technical program of the 41st National Metal Congress and Exposition.

Papers may be submitted any time up to Apr. 15, 1959, for consideration for presentation at this convention. The selection of approved papers for the convention technical program will be made in May 1959. Manuscripts may be submitted any time during the year and upon acceptance by the Transactions Committee will be processed immediately for preprinting. All papers accepted will be preprinted and made available to any members of the Society requesting them. However, the printing of an accepted paper does not necessarily infer that it will be presented at the convention. Reprinting of accepted papers is done quarterly; notification of their availability is published in *Metals Review*.

Manuscripts in triplicate, plus one set of unmounted photographs and original tracings, should be sent to the attention of Ray T. Bayless, assistant secretary, American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio.

Should it be your intention to submit a paper, please notify A.S.M. A copy of the booklet entitled "Suggestions to Authors in the Preparation of Technical Papers" will be gladly forwarded. This booklet may help considerably in the preparation of line drawings and illustrations.

A.S.M. spends $44.50 to service each member of the Society for a period of one year.

Talks on High-Temperature Corrosion at Detroit Course

Speaker: J. R. Schley
Haynes Stellite Co.

J. R. Schley, manager, technical services, Haynes Stellite Co., gave a talk in **Detroit** on "High-Temperature Corrosion".

Mr. Schley discussed the general problem of high-temperature corrosion in some detail, pointing out the actual mechanics of the reactions involved. He then reviewed the effects of oxygen, hydrogen, nitrogen and sulphur-bearing gases and liquid metals on ternary alloys of chromium-nickel and molybdenum as well as most of the standard grades of stainless steels. He illustrated his talk with slides showing laboratory examples of the above along with examples of parts which had failed in the field. Of particular interest was the illustration of the phenomenon of the formation of subsurface voids by leaching of chromium or nickel in a system subjected to high-temperature corrosion.—**Reported by W. P. Herbert for Detroit.**

ASM-SLA Literature Classification Ready

The ASM-SLA Metallurgical Literature Classification, International (Second) Edition, is now available from A.S.M. headquarters. Brought up to date and greatly expanded over the first edition published in 1950, it is the product of two years work by a special committee of the American Society for Metals under the chairmanship of Frank T. Sisco, director, Engineering Foundation.

Close collaboration in its preparation was also maintained with a number of European groups, notably the Italian Association of Metallurgy, the Verein Deutscher Eisenhuttenleute, and the Subcommittee on Technical Research of the European Coal and Steel Community (C.E.C.A.).

The classification, together with descriptive text, is published in an 80-page book, 8½ by 11 in., spiral bound in hard covers. A set of loose leaf "work sheets" is also available for the individual who wishes to expand or modify the standard classification to include special areas of subject interest.

While the classification has a wide range of uses for classifying, indexing and organization of literature files by conventional methods, it is also designed for use with a marginal punched card filing system. Specially designed cards for use with the second edition are available from Lee F. Kollie Associates, Inc., Chicago 1, Ill.

A coupon for ordering the classification book and work sheets from A.S.M., and the punched cards and necessary equipment from the Kollie Associates, will be found on page 73.

Describes Sendzimir Mill at Worcester

James F. Fox, Sendzimir Mill Division, Waterbury Farrell Foundry & Machine Co., Spoke on "A New Rolling Process, Sendzimir Mill" at a Meeting of Worcester Chapter. Shown are, from left: Mr. Fox; Walter J. Nartowt, chairman; Anton Brasunas, director of the Metals Engineering Institute, who presented the first diploma awarded by the Institute; Raymond W. Gilbert, Jr., metallurgist, Wyman-Gordon Co., who received the diploma; and Arnold L. Rustay, technical director, Wyman-Gordon Co.

Donates Money for Technical Library

Doug Ballard, Chairman of the Albuquerque Chapter, Is Shown Handing a $100 Check to Smiling University of New Mexico Student, James McCullough. Charles T. Grace, head of the metallurgical engineering department, and student, Donald McClung, witness the transaction. The money will be used to help equip the Pi Tau Sigma Technical Library and Study Room

Albuquerque Honors Young Scientists

Albuquerque Chapter Honored Three Regional Winners of the National Science Teachers Association Science Achievement Awards. Gwyneth Jones, eighth grader from McKinley Junior High, won an award for her paper on "A Study of Acceleration"; Baylor Triplett, ninth grader at Jefferson Junior High produced a winning project on "Problems and Solutions Encountered in Designing and Building a Cosmic Ray Research Vehicle"; and Richard Broemmer, ninth grader, Garfield Junior High, won with a project on "Cobalt 60 Absorption". Each was given a $10 check by the Chapter, which also honored the two teachers who sponsored the students

Oregon Holds Student Affairs Night

Shown at Oregon Chapter's Student Affairs Night Meeting Are, From Left: Samuel H. Graf, Consulting Engineer; George W. Gleeson, Oregon State College; Larry D. Towell, Who Was Awarded a $100 Scholarship; Olaf G. Paasche, Chairman of the Student Affairs Committee; and James C. O'Gara, who is in the Industrial Arts Department of the Portland Public Schools

Speaker: G. W. Gleeson
Oregon State College

At the annual Student Affairs Night of the **Oregon Chapter,** held on April 11th, the $100 scholarship was won by Larry Dale Towell, a senior student at Benson Polytechnic High School in Portland. His winning project was a set of highly polished brass and copper chessmen. Young Towell was also presented an engraved zirconium plaque to be turned over to Benson Tech for having the scholarship winner.

Olaf G. Paasche, professor at Oregon State College and chairman of the student affairs committee, made the presentations. Also assisting on the student affairs committee were William H. Rice, consultant, Electric Steel Foundry, and Haruo Kato, metallurgist, U. S. Bureau of Mines. The committee screened candidates from metropolitan Portland schools and are to be commended for their efforts and excellent choice.

The coffee talk was presented by James C. O'Gara, supervisor of the industrial arts department, Portland Public Schools, who discussed "Industrial Education", in which he gave a resume of the field of education. He presented a logical and economic view for the capital needs of the metropolitan school district.

George W. Gleeson, dean of engineering, Oregon State College, spoke on "Eclectism and Man", a talk which gave his views on current speed-up of technical education and a discussion on the historic rise of past civilizations. Individually, he maintained, man has "free will", which is probably but a numerical attribute of his thinking processes. He has, at various critical historical periods, been presented with situations in which, as a group, he made a choice or choices or came to decisions. Some of the decisions were partially subconscious. Others were a result of intense consideration and directed thought. Some were emotional. Some were a reflection of environmental circumstance. Eclecticism, in a broad sense, coupled with ecology, has brought man to his present state. Unfortunately, implementation following decision has been quite variable in terms of time for related areas of endeavor. Such unequal development has resulted in maladjustments and misunderstandings. Accordingly, short-term objectives and expediencies overshadow the nature of man's existence. Long-time patterns are forgotten in the complexities of daily living.—**Reported by R. A. Wilson for Oregon.**

Metals Information Film Goes Around the World

A remarkable popularity record has been chalked up by the A.S.M. film "The Metals Information Center of Tomorrow". Produced a little over a year ago for premier showing at the National Metal Exposition in Chicago, November 1957, it had been shown a total of 161 times by Oct. 1, 1958.

The film has been shown in 29 states, the District of Columbia, Canada, Brazil, Scotland, Russia, Spain, Germany, France, Holland and England, with unfilled requests from several other countries. By invitation a print of the film was sent to the Edinburgh Film Festival during August.

In addition to a number of A.S.M. chapters, members of a wide range of professional societies have viewed the film at local or national meetings. These groups include societies of chemists, mechanical engineers, military engineers, aeronautical engineers, electrical engineers, computer engineers, doctors, lawyers, librarians, nurses, management engineers, physicists, and many others.

The film was produced for A.S.M. by the staff of the Center for Documentation and Communication Research at Western Reserve University in the studios of the educational TV station WQED-TV, Pittsburgh. It describes in laymen's terms the A.S.M. Machine Literature Project at Western Reserve University. It is a 16-mm. sound, color movie, with a running time of 14 min.

Ten prints of the film are available for loan. Requests for showings before A.S.M. chapters or any other technical or educational groups should be addressed to American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio.

Montreal Mixes Business and Pleasure

At the Annual Ladies Night Meeting of the Montreal Chapter, Stewart Richardson, Northern Electric Co., Gave a Talk Entitled "Never Underestimate the Power of a Woman". Offices for the coming year were elected at this meeting and shown above are, from left: R. Thompson, incoming chairman, and Mrs. Thompson, and Mrs. Keith Shaw and Mr. Shaw, outgoing chairman. (Reported by G. F. Norman for Montreal Chapter)

Machining by Electrical Discharge Tri-City Topic

Speaker: J. L. Montgomery, Jr.
Elox Corp.

Joseph L. Montgomery, Jr., vice-president and sales manager, Elox Corp., spoke on "Electrical Discharge Machining" at a meeting of **Tri-City.**

Mr. Montgomery pointed out that this is the only new method of machining developed in the 20th Century. All other methods use mechanical energy whereas this method uses electrical energy only. In electrical discharge machining, the male electrode is made into the form of the finished part and an electrical current is used to vaporize the surface of the part being machined. The surface of the part is vaporized by the electrical current and washed away by a circulating dielectric coolant. This method can be used on complicated shapes and holds them to very close tolerances. Materials that formerly had to be ground, such as tungsten carbides, can now be machined. **—Reported by John B. Peck for Tri-City Chapter.**

Dayton Sponsors Course on Metallurgy of Light Metals

The 1958 educational program presented by the **Dayton Chapter** featured four lectures on the subject of "Metallurgy of Light Metals". Meetings were held at the E. J. Brown School in Dayton and the speaker for all four meetings was James F. Corwin of Antioch College. Lectures were: General Structure of Metals; Aluminum and Its Alloys; Magnesium and Its Alloys; and Titanium.

Certificates of attendance were presented to 47 persons.—**Reported by D. Ashfal for Dayton.**

Rockford Completes Educational Series

Karl Hein, Chairman of the Educational Committee, D. A. Campbell, Chairman of the Rockford Chapter, and Wilbur Shurts, Twin Disc Clutch Co., Are Shown During the Final Session of Rockford's Educational Lecture Series

The **Rockford Chapter,** in cooperation with the Rockford Men's College, held a five-week course on "Applied Steel Metallurgy". There was a total of 132 enrollments, including 120 nonmembers. Twenty-three business firms, the Air Corps and Northern Illinois University were represented in the group. An average attendance of 112 included men who drove from 15 localities outside the Rockford area.

The subjects and speakers were:

"Steel Nomenclature Systems", by Freeman Anderson, National Lock Co.

"Heat Treating of Steel", by Richard C. Stroker, Barber-Colman Co.

"Steel Testing and Inspection, Methods and Techniques", by Francis G. Tatnall, Tatnall Measuring Systems Co.

"Tool and Die Materials", by Malcolm Judkins, Firth Sterling Steel Co.

"Steel Specification and Usage", by Wilbur F. Shurts, Twin Disc Clutch Co.

Included as part of the curriculum of the course was attendance at one of the Chapter's regular dinner meetings. Each participant was given a copy of Bethlehem Steel Co.'s book "Modern Steels and Their Properties" and a copy of the Rockford Chapter's 1958 yearbook, which includes a number of tables for reference relative to steel. They also received a "Toolsteel Comparison Chart" and a "Glossary of Steel Terms", issued by Firth Sterling Steel Co., and a hardenability calculator slide rule was given to them by Bethlehem Steel Co.—**Reported by Glen Sandstrom for Rockford.**

Explains X-Ray Diffraction Methods

Shown at a Meeting of Puget Sound Chapter Are, From Left: Earl Roberts, J. E. Kamitchis, H. L. Southworth and C. B. Holder. Mr. Kamitchis, research engineer, Boeing Airplane Co., discussed "Applications of X-Ray Diffraction and Spectroscopy", covering effects of cold work, phase transformation of 17-7Ph stainless steel, phase studies in titanium alloys and lattice distortion in copper and brass. (Reported by E. E. Bauer)

Chicago-Western Seminar On High-Strength Metals

"High-Strength Metals" was selected as the subject of the third annual seminar by the **Chicago-Western Chapter,** which drew an attendance of approximately 160.

The seminar program consisted of five talks, as follows:

Fundamentals of the Strength of Metals, by J. O. Brittain, Northwestern University.

Metals With High - Temperature Strength, by L. P. Jahnke, General Electric Co.

Progress in Understanding the Heat Treatment of Steel, by R. A. Grange, United States Steel Corp.

Ultra-High Strength Steels, by D. C. Smith of Harnischfeger Corp.

Embrittlement of High - Strength Steels, by E. P. Klier, Syracuse University.

S. R. Callaway, Electro-Motive, and J. D. Graham, International Harvester Co., were technical chairmen.

The seminar was planned as a coordinated series of talks to develop the selected subject.

Cites Salt Bath Advantages

R. J. Polivka (Standing), Chairman, Introduces the Guest Speaker, Q. D. Mehrkam, Ajax Electric Co. (to His Right), to Members of The Carolinas Chapter. Mr. Mehrkam gave a talk on "Modern Applications of Salt Bath Heat Treating". (Photo by W. E. Cheshire)

Speaker: Q. D. Mehrkam

Ajax Electric Co.

Q. D. Mehrkam, metallurgist, Ajax Electric Co., spoke on "Modern Applications of Salt Bath Heat Treating" at a meeting of **The Carolinas.**

Since the first important commercial installation of salt baths in this country, less than 30 years ago, salt bath furnaces have achieved wide recognition. Growth has been rapid, not only in the number of units installed but in the size and capacity of these units, a reflection of the industrial growth of this country and an indication of the many fields in which this equipment is demonstrating its usefulness.

The introduction of the removable submerged electrode has materially lengthened the service life of salt bath furnaces operating within the 1200 to 2400° F. range, and has minimized costly shutdowns. Formerly, submerged electrodes entered the furnace through the pot wall. Subsequent development led to electrodes which combine the long life of submerged design with easy replaceability. The removable submerged electrode enters the furnace from over the top, yet it is a true submerged electrode since all air is effectively sealed off by means of an easily lifted tile over each pair of electrodes. The electrodes are replaced during operation of the furnace simply by lifting the cover tile, removing the old electrodes, and installing a new or rebuilt pair, and then replacing the cover tile.

A great deal of study and development has been devoted to the problem of increasing the quenching severity of a salt bath isothermal quench furnace. It has long been recognized that the cooling power of a quenching medium is related to the velocity of flow past the surfaces of the article being quenched. By reversing the direction of flow of salt in a quench header so that it moves downward instead of upward, a distinct improvement is obtained in the rate of cooling. A uniform quenching severity is obtained throughout the quenching area which is difficult to obtain by baffling upward flow. Regardless of the pump speed or quenching media, downward flow is appreciably more effective than upward flow.

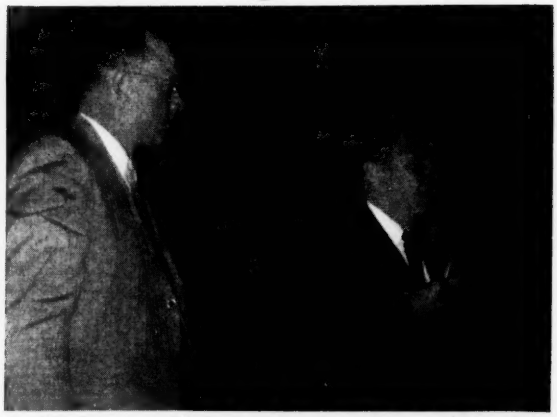
There is a further advantage to be gained by the addition of water to a nitrate-nitrite type salt used in isothermal quench furnaces. An investigation of this practice brought out these interesting facts:

1. Water in a large amount can be added to a nitrate salt at a temperature of 400° F. or less with no explosive reaction.
2. This water, while readily absorbed, will boil off as steam in the matter of hours, and therefore requires periodic replacement.
3. The cooling power of a salt containing up to 1% water is improved beyond the quenching severities that can be obtained by agitation alone.
4. Although no means is available to automatically control the percentage of water in the salt, its presence is readily detected by visual inspection at the time of quenching. As demonstrated by cooling curves and by results obtained in actual installations, higher hardnesses and improved physical properties can be readily obtained by applying these improvements to the heat treating practice.
5. The relatively recent introduction of aluminum brazing paste has greatly facilitated aluminum brazing of assemblies which formerly presented difficult joint areas for application of brazing alloy.

An interesting modification of salt bath brazing combines carburizing and brass brazing in one step. A carburizing bath is an excellent medium for brazing and by selecting a bonding material and melting at the correct temperature, it is entirely practical to secure the necessary carburizing in its normal time cycle while at the same time providing for an excellent braze on several parts. The assembly, on being withdrawn from the carburizing furnace, can be quenched in the normal manner to develop the required hardness. The self-fluxing characteristics of a cyanide-containing salt add considerably to the wetting and flow characteristics of the brazing alloys. In addition to brazing, the carburized case provides added wear resistance for the assembly.

Many interesting applications have been made in neutral hardening, annealing, aluminizing, billet heating, cleaning contaminations from all types of molds, coloring and blueing, desanding, descaling, heating for forging and extrusion, liquid flame heating, paint stripping, precipitation hardening, solution heat treatment, and other specal applications where molten salt is used as a heat transfer medium.—**Reported by P. A. Stalder for the Carolinas.**

G. M. Young at St. Louis



G. M. Young (Right), Then President A.S.M., Who Spoke on "New Plans and Progress of A.S.M." and "Light Alloys in Heavy Industry" at a Meeting of the St. Louis Chapter, Is Shown With George Fisher, a Member of the Chapter and Then Trustee of A.S.M.

Nuclear Congress Scheduled

The American Society for Metals is one of the 31 sponsors of the "1959 Nuclear Congress" to be held Apr. 5 to 10, 1959, in Cleveland's Public Auditorium. Any A.S.M. member who wishes to submit a scientific or technical paper on any phase of the peaceful use of the atom is invited to send immediately a brief abstract of the proposed paper to T. C. DuMond, American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio, who will forward it to the proper official of the Nuclear Congress.

A. S. M. METALLOGRAPHIC AWARDS — 1958

Best in Show
Francis F. Lucas Award

J. C. Gower, E. P. Griggs, W. E. Denny, J. E. Epperson and R. J. Gray
Oak Ridge National Laboratory
Union Carbide Nuclear Co.
Metallurgy Division
Oak Ridge, Tenn.
"Single Crystal Copper Spheres"

Class 1—Cast Iron and Steels

Honorable Mention: Donald J. Rossi and M. J. Savitski, K-90, Materials Engineering, Westinghouse Electric Corp., East Pittsburgh, Pa.—Eutectic Layer Formed on the Surface of Ingot Iron.

Class 2—Carbon and Alloy Steels (Wrought)

Best in Class: William F. Kindle, U. S. Steel Corp., E. C. Bain Laboratory for Fundamental Research, Monroeville, Pa.—Sodium Bisulphite as an Etching Reagent for Steel.

Honorable Mention: George T. Hahn and Miriam Yoffa, Dept. of Metallurgy, Massachusetts Institute of Technology, Cambridge, Mass.—Microcracks in Grain Boundaries of Vacuum Melted Iron.

Class 3—Stainless Steels and Heat Resisting Alloys

Best in Class: J. A. Nelson and W. Feduska, K-90, Materials Engineering, Westinghouse Electric Corp., East Pittsburgh, Pa.—Effect of Carbon Diffusion in Two High-Temperature Alloys.

Honorable Mention: James C. Wilkins, Armco Steel Corp., Research Laboratories, Middletown, Ohio—Typical Microstructures of Ferritic and Austenitic Stainless Steels.

Class 4—Aluminum, Magnesium, Beryllium, Titanium and Their Alloys

Best in Class: C. D. Carpenter and A. R. Donaldson, Physical Metallurgy Branch (Code 6320), Metallurgy Division, U. S. Naval Research Laboratory, Washington, D. C.—Eutectic Colonies of Sodium-Modified Aluminum-Silicon Alloy.

Class 5—Copper, Nickel, Zinc, Lead and Their Alloys

Best in Class: R. D. Buchheit and G. A. Wheeler, Battelle Memorial Institute, Columbus, Ohio—Nickel Alloy With 20% Cr, 6% Cb, 4% B, As Cast.

Honorable Mention: Clifford C. Hartelius, Research Laboratory, General Electric Co., Schenectady, N. Y.—Ni-Cr-Si Alloy Showing Precipitation of Ni_3Si on Slip Lines, Low-Angle Boundaries and Grain Boundaries.

Class 7—Metals and Alloys Not Otherwise Classified

Best in Class: John H. Miller, Sylvania Electric Products, Inc., Chemical and Metallurgical Division, Towanda, Pa.—Twinning in Zone-Purified Silicon Rod.

Honorable Mention: R. G. Babineau and J. F. Richards, Research and Advanced Development, AVCO Manufacturing Corp., Wilmington, Mass.—Fused Silica Sandwiched Between Plates of Tantalum.

Honorable Mention: R. D. Buchheit and L. Dillinger, Battelle Memorial Institute, Columbus, Ohio—Hardness Versus Grain Orientation in Zone-Melted Cobalt.

Class 8—Series Showing Transitions or Changes During Processing

Honorable Mention: J. Tracy and J. Gurland, Division of Engineering, Brown University, Providence, R. I.—Deformation Study of Two-Phase Alloy of Tungsten Carbide and Cobalt.

Honorable Mention: Pierre A. Jacquet, Marine Nationale, Paris, France—First Appearance in a Light Alloy of Frank-Read Dislocation Mills Decorated by Precipitates.

Honorable Mention: A. Saulnier, Pechiney, Service des Recherches et Essais Physiques de Chambery, Chambery, France — Transformation of Beta Phase in Ti-6Al-4V Alloy.

Honorable Mention: Adam Ling, Ford Motor Co., Manufacturing Research Office, Process Development Dept., Tool and Die Plant, Rouge, Dearborn, Mich.—Bainitic Transformation of Nodular Iron.

Class 9—Welds and Other Joining Methods

Honorable Mention: John Paulina, Metallographer, and Karl M. Weigert, Curtiss-Wright Corp., Research Division, Quehanna, Pa.—Permeable Metal (Poroloy) Brazed to Superalloy (Haynes 25).

Honorable Mention: John A. Winn, Metallurgist, and Fred C. Hashagen, Metallurgy Technician, Fairchild Engine Division, Deer Park, L. I., N. Y.—Brazed Joint in 17-7 PH.

Class 10—Surface Coatings and Surface Phenomena

Best in Class: William A. Roman, Research Laboratory, General Electric Co., Schenectady, N. Y.—Crystallites of Nickel on a Cube Face of a Nickel Oxide Single Crystal.

Honorable Mention: R. D. Buchheit, J. L. McCall and C. H. Brady, Battelle Memorial Institute, Columbus, Ohio—Oxidation of Tantalum.

Honorable Mention: J. Bruce Wagner, Jr., Hammond Metallurgical Laboratory, Yale University, New Haven, Conn.—Spiral Growth of an Oxidized Film on Iron.

Class 11—Slags, Inclusions, Refractories, Cermets and Aggregates

Best in Class: Erwin R. Cprek and Jere L. Crawford, Research Staff, General Motors Corp., Warren, Mich. — Experimental Cermet - Tungsten Fibers in a Chromium Alumina Matrix.

Honorable Mention: E. N. Silverman, Applied Research Laboratory, U. S. Steel Corp., Monroeville, Pa.—Synthetically Prepared Inclusion of Manganese Sulphide and Silicate.

Class 12—Electron Micrographs

Best in Class: R. L. Scott and R. V. Coleman, General Motors Research Laboratories, Detroit, Mich.—Deformation Bands on Iron Whiskers Formed at Liquid Nitrogen Temperature.

Honorable Mention: Charles F. Tufts, Ruth Smith and William J. Feminella, Sylvania Research Laboratories, Sylvania Electric Products, Inc., Bayside, N. Y.—Undoped Tungsten Wire After Annealing.

Honorable Mention: R. L. Scott and R. V. Coleman, General Motors Research Laboratories, Detroit, Mich.—Growth Steps and Dislocation Etch Pits on Iron Whiskers.

Class 13—Results by Unconventional Techniques

Honorable Mention: Barbara A. Thompson and Anthony Kapusta. General Engineering Laboratory, General Electric Co., Schenectady, N. Y.—Attack of Inco 702 by Boron —Simultaneous Autoradiograph and Optical Macrograph.

Honorable Mention: T. K. Bierlein and B. Mastel, Hanford Laboratories Operation, General Electric Co., Richland, Wash.—Autoradiograph Using Saran Replica.

(*Continued on p.* 16)

Northeast Ohio Chapters Hold Regional Meeting

Shown at the First Northeastern Ohio Regional Meeting on "Aircraft and Guided Missiles and Alloys" Are, Front, From Left: H. C. Barnett, N.A.S.A.; Edgar H. Dix, Jr., Aluminum Co. of America; K. Humberstone, Technical Chairman; G. M. Ault, N.A.S.A.; and Edward J. Dofter, Chrysler Corp. In the back row, from left, are: R. G. Frank, General Electric Co.; C. Campbell, Cleveland Chairman; M. E. Carruthers, Armco Steel Corp.; W. J. Finlay, Crucible Steel Co. of America; J. Kirkpatrick, Brooks & Parks; and A. Brasunas, Regional Meeting Chairman. Buford Sparks and V. Blanco were not present for the photo

Well over 250 registrants attended the first Northeastern Ohio A.S.M. Regional Meeting on "Aircraft and Guided Missile Alloys" held in Cleveland. Akron, Canton-Massillon, Mahoning Valley and Warren Chapters, with Cleveland Chapter as host, participated in this one-day meeting.

Following the opening presentation by E. J. Dofter, Chrysler Missile Division, on "Material Requirements for New Aircraft and the Guided Missile Alloys", speakers presented data concerning a specific metal or alloy group, emphasizing properties, present areas of utility and potential applications in aircraft and guided missiles. In the morning session, M. E. Carruthers, Armco Steel Corp., spoke on steels, while superalloys and refractory metals were covered by R. G. Frank, General Electric Aircraft Gas Turbine Division.

At luncheon, H. C. Barnett, N.A.S.A., presented an interesting talk entitled "High-Energy Fuels". He reported that the hope for a high-energy fuel lies in the elements hydrogen, beryllium and boron (or their compounds), since each has heats of combustion higher than hydrocarbons. Of the three, boron is especially of interest because it is plentiful and relatively easy to handle. At present, compounds of boron, carbon and hydrogen appear most promising, but needless to say, much additional research is required before these fuels can be fully utilized in aircraft.

In the afternoon sessions, talks concerning titanium, magnesium and aluminum alloys were presented by W. L. Finlay, Titanium Division, Crucible Steel Co. of America, J. Kirkpatrick, Brooks and Perkins, Inc., and G. M. Ault, N.A.S.A. Panel members, including Buford Sparks of the Clevite Research Center, in addition to the above speakers, discussed a wide variety of interesting points and questions submitted by the audience.

Perhaps the over-riding theme of the regular sessions was that no one particular metal or alloy can best serve the extremely complex design and variable property requirements called for in aircraft and guided missiles. Where lightness is the only factor to be considered, magnesium and its alloys, and possibly beryllium, are logical choices; in cases where strength at increasing temperatures is required, any number of materials might be best, depending on stress-temperature-time requirements. What is important is that each material be utilized to its fullest advantage, for what may be a best combination of properties for one application may be far from best in another.

Following an excellent dinner, the meeting was appropriately concluded by V. M. Blanco who described "What the Sputniks and Explorers Have Told Us About Outer Space".

So well attended and received was the first series of talks and discussions that plans for a second Northeastern Ohio Regional Meeting are already underway, with the Akron Chapter to serve as host, in the late spring of 1959 on the subject of "Materials for Nuclear Reactors".—**Reported by Lewis W. Berger for Cleveland Chapter.**

Class 14—Color Prints in All Classes

Best in Class: L. C. Gower, E. P. Griggs, W. E. Denny, J. E. Epperson and R. J. Gray, Oak Ridge National Laboratory, Union Carbide Nuclear Co., Metallurgy Division, Oak Ridge, Tenn.—Single Crystal Copper Spheres. **(Best in Show)**

Honorable Mention: J. A. Nelson, K-90, Materials Engineering, Westinghouse Electric Corp., East Pittsburgh, Pa.—Stainless Steel Tubes Brazed With Ni-Cr-P Alloy.

Honorable Mention: C. Patrick Kenyon, Chief Metallographer, Sheffield Division, Armco, Kansas City, Mo.—Titanium Nitride Inclusions in Gray Cast Iron.

Honorable Mention: R. J. Gray, Anthracology Section, Applied Research Laboratory, U. S. Steel Corp., Monroeville, Pa.—Polished Thin Section of Coal From Robena Mine, Pittsburgh Seam.

Milwaukee Members Tour A. O. Smith Corp. Plant

Over 100 members and guests of the **Milwaukee Chapter** toured the A. O. Smith Corp. during the Chapter's annual plant tour.

The tour commenced with a visit to the pipe shop where 22 in. diameter by 40-ft. long sections of line pipe were being produced. Of interest were the three flash-butt welding machines in which welding of the entire length of the pipe was completed in approximately 1 min. Nearly one million amperes of current is used to weld a single section. The main tool room and inspection area were toured as well as the aeronautical division.

Following a luncheon the tour continued in the vessel division where pressure vessels for the chemical and petroleum industries and glass-lined storage tanks for the brewing industry were being fabricated. In the electrode division, the manufacturing procedure for welding electrodes, from finish sizing and cutting of the core wire to the application of the flux coating and its drying sequence, to the final quality checks and packaging, were observed. A few of the laboratories which are located in the research and development science building were also visited, including the electrode development, welding, metallurgical and fatigue testing laboratories. A look in on the display hall, where past and present products of the A. O. Smith Corp. are exhibited, completed the tour.—**Reported by David D. Legg for Milwaukee Chapter.**

Basic Fundamentals of Metallurgy Oregon Topic

The Oregon Chapter's spring educational series on **"Basic Fundamentals of Metallurgy"** was directed by O. G. Paasche, associate professor of mechanical engineering, Oregon State College, who also presented the five lectures. The subjects of Prof. Paasche's lectures were: The Structure of Metals; Alloys of Metals; Cold Working and Annealing; Heat Treatment; and Hardenability and Corrosion. The course followed Clyde Mason's text "Introductory Physical Metallurgy".

Prof. Paasche's presentation held the interest of the entire group throughout the series, stimulating many good questions from the floor at the end of each session. A.S.M. members in attendance who could qualify as experts in this field, assisted Prof. Paasche in answering the questions. From audience reaction, it appears that this was one of the most successful series yet conducted.

Julien Waganet, metallurgist, U. S. Steel Corp., chairman of the educational committee, reported that 220 persons completed the course and received a diploma.—**Reported by R. A. Wilson for Oregon.**

New Films

Material Handling Techniques

The Material Handling Institute, Inc., has announced a film strip that illustrates the material handling techniques employed in a wide variety of industries. Cost of the film is $15 to educational institutions and $20 to industry. This fee includes a comprehensive film script describing the action in each photo. Film may be obtained from: Irving M. Footlik, Secretary, College-Industry Committee on Material Handling Education, 9116 Four Winds Way, Skokie, Ill.

Nature of Glass

A 37-min. 16-mm. sound and color film describes the basic structure of glass and illustrates major types of glasses and their properties. Production and finishing processes and end uses as an enigneering material are also presented. The film is available from its producer, Corning Glass Works, Corning, N. Y., or through Association Films regional distribution centers in Ridgefield, N. J., La Grange, Ill., San Francisco and Dallas.

Futures in Steel

Bethlehem Steel Co. has produced a 28-min. film which explores today's basic steel industry, from the early American ironmaking site at Saugus, Mass., through modern processes and applications. Throughout runs the theme of men and their accomplishments, what they have done in the past, what they are doing today, what they plan for the future. It is a story of production on a vast scale, of the tremendous strides in technology, new products and uses where steel is basic. The film is distributed through Modern Talking Picture Service, 3 East 54th St., New York 22, N. Y., or its exchanges in major cities.

Interface Flow in Tandem Extrusions of Plasticene

A 16-mm. film produced by Nuclear Metals, Inc., presents some of the material flow characteristics of tandem and clad-tandem extrusions and the formation of some "problem" interfaces similar to those encountered in the fabrication of nuclear fuel elements. The pictures were taken through a glass-windowed plane-strain extrusion press during the deformation of plasticene composite billets. The film is silent, with captions, and is partly in Kodachrome. Viewing time is 18 min. Requests should be addressed to: Nuclear Metals, Inc., 224 Albany St., Cambridge, Mass.

Three Students Complete MEI Heat Treating Course

The Metals Engineering Institute has just awarded certificates to the first three graduates of M.E.I. Course No. 10—Heat Treatment of Steel—which was written by George F. Melloy, Bethlehem Steel Corp.

First to complete the course was Ernst L. Olving of Bethlehem Pacific Coast Steel, Seattle, Wash., second was Emil P. Tichy, Jenkins Bros., Bridgeport, Conn., and third was Michael Zukowsky, Canadian Pacific Railway, Winnipeg.

Many other enrollees are nearing completion and have indicated that they are benefiting greatly from their heat treating studies.

The Institute now has graduates in three of its 20 available subjects—Elements of Metallurgy, Heat Treatment of Steel and High-Temperature Metals.

For complete information about M.E.I., see page 68.

Pennsylvania Chapters Hold Biennial Meeting

The 11th Biennial Pennsylvania Interchapter Meeting of the American Society for Metals met on Nov. 14-15, 1958, at University Park, Pa., under the auspices of the Metallurgy Department of the Pennsylvania State University and the Penn State Chapter. The subject of the symposium was "Production Methods and Operations Research in Metallurgy".

The program included linear programming methods for metallurgical operations, computer methods of controlling operations and automation techniques.

Further operations discussed included the operation of the coke oven, sintering, the rolling mill, machining and the electric furnace.

Montreal Holds Golf Social

The Annual Golf Tournament held by the **Montreal Chapter** was an unqualified success with an attendance of 176 players and 220 at the dinner. Fred Payne won the low gross for members with a 79, while Bill Kryskow captured the guest prize with a 75. A visiting team from the Toronto Chapter was defeated by two of the Chapter's past chairmen, Carl Baker and Keith Shaw. The prize for this event was presented by National President G. M. Young.—**Reported by R. H. Peck for Montreal.**

A.S.M. is the largest publisher of books for the metals industry in the world.

Talks on Explosive Shock

Cyril Stanley Smith (Left), Institute for the Study of Metals, University of Chicago, Who Spoke on "Metallographic Studies of Metals After Explosive Shock" at Los Alamos, Is Shown With Arthur Coffinberry

Speaker: C. S. Smith

Institute for the Study of Metals

Cyril Stanley Smith, Institute for the Study of Metals, University of Chicago, presented a talk on "Metallographic Studies of Metals After Explosive Shock" at a meeting of the **Los Alamos Chapter.**

Metals subjected to shock loading have been studied quite extensively. However, in all of these cases, the metal under study was shock loaded by either a converging or diverging shock wave instead of by a plane shock wave. Generally, the recovered pieces had undergone considerable deformation in their return to normal pressure. Therefore, it was virtually impossible to conduct a systematic study on the effect of high pressure on metals. By using a special recovery technique developed by one of the groups at Los Alamos, essentially undamaged specimens subjected to plane shock waves to 600 kilobars were recovered after shock.

Samples of OFHC copper were shocked to pressures of 225 and 425 kilobars. Many of the samples at low pressure and all of the samples at the higher pressure developed numerous markings which at high magnification had all of the microscopic characteristics of twins. This was a unique finding, since twinning in copper had been observed only after severe deformation at low temperature or after irradiation. These twins formed preferentially at 30° to the direction of shock and not at 45°, the angle of greatest shear. The hardness after shock loading to 425 kilobars was greater than that of the same material which had been reduced 65% by cold rolling.

Alpha brass subjected to plane shock to a pressure of 550 kilobars developed a marked structure, but these markings resembled slip more than twinning. Also, the markings were predominant at 45° to the direction of shock rather than at 30° as was found for pure copper.

It has already been shown that there exists a double plastic shock in iron which is associated with a discontinuity in the PV curve at about 130 kilobars shock pressure. From a consideration of this, a single shock wave would be expected below 130 kilobars, a 130 kilobar shock followed by a higher shock pressure to about 230 kilobars, and a single shock wave again at pressures above 330 kilobars. Shock pressures below 130 kilobars produced only simple well-defined Neumann bands. As the shock pressure increased, the microstructures became more complex and finally, simpler. Appearance of the twin markings of each grain was quite dependent on its orientation, some grains being heavily twinned while an adjacent grain might be essentially twin free.

Iron disks inserted into the surface of a brass wedge showed some interesting structures which were due to the interaction of the rarefaction wave from the first shock with the second shock. This reduced the pressure of the second shock wave. Thus, the metal subjected to the higher pressure was that through which the second shock wave had passed before the interaction with the rarefaction wave. The low-pressure and high-pressure zones were clearly differentiated metallographically. Microhardness traverses from the low pressure surface (free surface) showed a pronounced hardness increase at this junction. From hardness and microscopic examination, the relative shock velocities could be calculated and the actual shock pressure determined.

The effect of orientation and prior treatment on Armco iron is now being studied.—**Reported by E. G. Zukas for Los Alamos.**

Quenching Practices Topic

Orville Cullen, Chief Metallurgist, Surface Combustion Corp., Discussed "Quenching Practices" at Rockford Chapter. Shown are, from left: M. Kobrin, coffee speaker; D. Campbell, chairman; and Mr. Cullen

Speaker: Orville Cullen

Surface Combustion Corp.

Orville Cullen, chief metallurgist, Surface Combustion Corp., spoke on "Quenching Practices" at a meeting of the **Rockford Chapter.**

Quenching practices are quite versatile in restoring and developing properties in steel, using mediums such as oil, water, air, molten salt and metal, brine and caustic.

Mr. Cullen illustrated with slide graphs and charts the S-curve relationship to the quenched properties of steel and the relative cooling rates of quenching mediums. The development and understanding of TTT-curves aid in the choice of the quenching medium. Mr. Cullen pointed out that three distinct stages occur during the quenching operation, defined as the "A" stage (vapor blanket stage), "B" stage (vapor transport stage), and "C" stage (slow cooling stage).

Mr. Cullen reviewed several well-known laboratory instruments used to rate the heat transfer ability and effectiveness of quenching media. Systems used for handling parts for heat treating are designed to convey various size parts through a furnace and a quenching media. Care in loading parts for uniform contact with the quenching medium will minimize dimensional changes caused by slight nonuniform cooling and transformation rates. There are many solutions to correct fixturing, often the choice is determined by experimentation. Workpieces of nonuniform cross sections often exhibit final dimensional changes during quenching which are inherent because of their size or shape.

In conclusion, Mr. Cullen reviewed distortion and growth data of heat treated parts in a marquenching process.—**Reported by G. W. Sandstrom for Rockford.**

A.S.M. created the Annual Teaching Award in Metallurgy, open to teachers of metallurgy in the United States and Canada. Value $2000.

Cleveland Chapter Holds Panel on Heat Treating

Members of the "Stump the Experts" Panel Which Held Forth at the First Meeting of the Cleveland Chapter This Season Included, Seated, From Left: C. Leland, General Motors Corp.; W. Hendershot, Hendershot & Smith; E. J. Cox, Pittsburgh Commercial Heat Treating; and G. Moline, Metallurgical, Inc. Standing, from left: K. Humberston, chairman; M. Frey, Allis-Chalmers Manufacturing Co.; T. Spencer, Caterpillar Tractor Co.; D. Girardi, Timken Roller Bearing Co.; and H. Boyer, ASM Metals Handbook

The Cleveland Chapter inaugurated its new season with a "Stump the Experts" night meeting held in the recently built Engineering and Scientific Center. This novel program attracted well over 200 members and guests to hear seven eminent heat treaters answer questions put to them by the audience. The panel included Elmer J. Cox, vice-president, Pittsburgh Commercial Heat Treating Co., M. L. Frey, Allis-Chalmers Manufacturing Co., D. J. Girardi, Timken Roller Bearing Co., Walter Hendershot, Hendershot & Smith, Claude Leland, General Motors Corp., Gordon Moline, Metallurgical, Inc., and T. H. Spencer, Caterpillar Tractor Co. This group had some real toughies to contend with since each wrong answer won a silver dollar for the questioner. Howard Boyer, A.S.M. Metals Handbook, was moderator of the panel.

Witness the following exchange:

Q. Given a plate 8 x 10 x 40 in. of either carbon or manganese-molybdenum steel, which works better, brine immersion quenching or water spray quenching?

A. I never heard of anything this size being quenched directly in brine. We would hold such an item in a fixture and spray-quench.

Q. How extensive is commercial austenitizing, what steels are being used, and what is the upper size limit?

A. There is little true austenitizing (that is, quenching to above the M_s and holding until transformed) of either carbon or alloy steel. Wire products, 0.18 in. diam., are quenched right at the M_s. Above this size, hardness will be all right, but the yield strength will be low.

Q. Why is more retained austenite transformed by cold treating directly after hardening rather than waiting until the part has been tempered?

A. Austenite will stabilize at near room temperatures; if it must be avoided, the metal should be immediately refrigerated. The more one delays, the more austenite will stabilize, and the less will transform when cold treatment is finally employed.

Q. Is there a good method for predicting case depth obtainable in induction hardened steels when the austenitized depth exceeds the effective hardened depth? Can this be done using conventional hardenability data from SAC or Jominy tests?

A. Yes, either test will predict hardness depth accurately. We've been doing it for 20 years.

Q. Does the lead in leaded free-machining steels have any effect on the heat treatment?

A. So far, none has been discovered. Neither hardenability nor carburizing are affected by the presence of lead.

Q. What precautions should be used when hardening or carburizing boron-treated steels?

A. No unusual handling is needed. Heat treating a steel containing boron is the same as heat treating a steel of comparable hardenability without boron.

Q. How cold can nitrided work be before entering quenching oil and still get a file-hard surface? Is a T-T-T curve known for a carbonitrided case?

A. There is no T-T-T curve known. As for the quenching temperature, that is a function of the nitrogen content. If the part is treated from 1300 to 1400° F., the nitrogen is high enough so that no quenching is needed. When treating temperatures are above this, there is still enough nitrogen so that only oil quenching is necessary.

There was much more of this. One question that produced some spirited remarks concerned a 4130 steel that hardened at 59 Rockwell C. At first, it was thought that the sample was high in carbon, and the question appeared to be answered until it was mentioned that the carbon was 0.32%, well within required limits. After much discussion about bandspread and hard spots, it was concluded that the question was unanswered, and the questioner got his silver dollar.

More panel question-and-answer programs are being planned by the Chapter. One that looks extremely interesting will concern "Castings Versus Forgings Versus Weldments." The National Guard may be needed for this one. **C.R.W.**

NOTICE OF CHANGE IN PUBLICATION

of

A.S.M. REVIEW OF METAL LITERATURE

Commencing Jan. 1, 1959, the *A.S.M. Review of Metal Literature* will be issued monthly as a separate publication. It will be sent without charge to all members of the American Society for Metals *who notify Society Headquarters* of their desire to receive it.

Metals Review, containing chapter and national Society news, will continue to be sent automatically to all members of the Society without charge.

Fill out and mail coupon on p. 67 if you wish to continue receiving the *A.S.M. Review of Metal Literature* as a separate publication.

CHAPTER MEETING CALENDAR

Birmingham	**Dec. 2**	Thomas Jefferson Hotel	**W. M. Murray, Jr.**	Projects and Progress at Southern Research Institute
Buffalo	**Dec. 11**	Continental Inn	**R. R. Tatnall**	Metallurgy of Steel Spring Wire
Calumet	**Dec. 9**	Phil Smidt	**R. B. Hildebrand**	Alumınizing of Steel
Canton-Massillon	**Dec. 2**	Mergus Restaurant		Metallurgical Factors Determining the Strength of Metals
Chicago	**Dec. 8**	Furniture Club	**Social**	Christmas Party
Chicago-Western	**Dec. 8**	Furniture Club	**Social**	Christmas Party
Cincinnati	**Dec. 11**	Engineering Society	**C. H. Lorig**	Selection of Materials in This Changing World
Cleveland	**Dec. 1**	Engineering Society	**Panel**	Tool Materials
Columbia Basin	**Dec. 5**	Elk's Club	**Social**	Smorgasboard
Columbus	**Dec. 3**	Lincoln Lodge	**C. H. Lorig**	Mrs. America and Metals
Dayton	**Dec. 10**	Engineers' Club	**Charles Gambill**	Uses of Radioisotopes in Industry
Detroit	**Dec.**		**Social**	Christmas Party
Eastern New York	**Dec. 9**	Panetta's Menands	**Social**	Christmas Party
Ft. Wayne	**Dec. 8**	Hobby Ranch House	**Social**	Ladies Night
Hartford	**Dec. 12**	Avon Country Club	**Social**	Christmas Party
Indianapolis	**Dec. 15**	Village Inn	**S. F. Kuhn**	Beauty in Precious Metals
Inland Empire	**Dec. 12**		**Social**	Annual Christmas Stag
Kansas City	**Dec.**		**Social**	Christmas Party
Lehigh Valley	**Dec. 5**	Hotel Traylor	**W. S. Pellini**	Implication of Space and Hypersonic Flight on Materials Development
Los Angeles	**Dec. 4**	I.A.S. Bldg.	**Round Table**	Short-Time Properties and Testing at Elevated Temperatures
Mahoning Valley	**Dec. 9**	Warren, Ohio	**Tour**	Copperweld Steel Corp.
Milwaukee	**Dec. 16**	City Club	**D. S. Billington**	Effect of Nuclear Reactor Radiation on Metals and Alloys
Minnesota	**Dec. 20**		**Social**	Christmas Party
Mohawk Valley	**Dec. 1**		**Tour**	Carrier Corp.
Montreal	**Dec. 1**	Queen's Hotel	**R. C. Stewart**	Hazards of Heat Treatment
Muncie	**Dec. 9**	Students Center	**F. S. Badger, Jr.**	High-Temperature Alloys
New Haven	**Dec. 5**	Waverly Inn	**Social**	Christmas Party
New Jersey	**Dec. 8**	Essex House	**Social**	Smoker
New York	**Dec. 1**	Brass Rail	**W. Bruckart**	Materials for 2000° F. and Up
North Texas	**Dec. 5**	Elks Club	**Social**	Christmas Party
Notre Dame	**Dec. 10**	Capri Restaurant	**K. M. Weigert**	High-Temperature Brazing Reactions and Physical Properties of Alloys
Oak Ridge	**Dec.**		**Social**	Dinner-Dance
Ontario	**Dec. 5**	Prince George Hotel	**J. B. Burk**	New Uses for Stainless Steels
Oregon	**Dec. 18**	Riverside Country Club	**Social**	Christmas Party
Ottawa Valley	**Dec. 2**		**E. C. W. Perryman**	Metallurgy of Zirconium
Penn State	**Dec. 9**			Radiation Damage
Philadelphia	**Dec. 12**	Broadwood Hotel	**Social**	Christmas Party
Philadelphia—Junior Section	**Dec. 12**	Broadwood Hotel	**Social**	Christmas Party
Pittsburgh	**Dec. 11**		**Social**	Winter Festival
Purdue	**Dec. 16**		**R. Speiser**	Electric Theory of Metals and Alloys
Richmond	**Dec. 10**	Holloway House	**G. Flynn**	Free Piston Engines
Rochester	**Dec. 8**	Manger-Seneca Hotel	**W. Crafts**	Recent Developments in Alloy Steel
Rockford	**Dec. 17**	Marengo, Ill.	**Tour**	Arnold Engineering Div., Allegheny-Ludlum Steel Corp.
St. Louis	**Dec. 9**	Coronado Hotel	**Social**	Christmas Dinner-Dance
Southeast Ohio	**Dec. 12**	Murphy's Restaurant	**Social**	Christmas Party
Texas	**Dec. 2**	Engineers Club	**R. P. Culbertson**	Properties Developed With Alloy Hard Facing Rods
Toledo	**Dec. 13**	Maumee River Yacht Club	**Social**	Christmas Party
Tri-City	**Dec. 9**	Armstrong Hotel	**Social**	Ladies Night
Tulsa	**Dec. 2**	Alvin Hotel	**R. W. Brown**	Jet Airplanes
Washington	**Dec. 8**	Dodge Hotel	**Oscar Marzke**	Some Recent Advances in Steel
Western Ontario	**Dec. 12**		**Panel**	Stump the Experts
West Michigan	**Dec. 15**	Schnitzelbank Restaurant	**D. W. Levinson**	Metals for Space Travel
Worcester	**Dec. 10**	Hickory House	**G. A. Roberts**	High-Temperature Alloys
York	**Dec. 10**	Lancaster	**Harry Hovis**	Processing of Special Alloys

A.S.M. Review of Current Metal Literature

An Annotated Survey of Engineering, Scientific and Industrial Journals and Books Here and Abroad Received During the Past Month

Prepared at the Center for Documentation and Communication Research, Western Reserve University, Cleveland.
With the Cooperation of the John Crerar Library, Chicago.

General Metallurgy

572-A.* (German.) **Dressing Dolomite During Thermal Production of Magnesium.** Ladislaus Jakoby. *Freiberger Forschungshefte,* no. B28, June 15, 1957, p. 42-49.

Study of dolomite in Hungary, its geology, possibility of its recovery and choice of fuel for silico-thermal reduction; availability of Hungary's energy resources.
(A-general; Mg, RM-n)

573-A.* (Italian.) **Germanium.** Giovanni Porro. *Industria Mineraria,* v. 9, Apr. 1958, p. 199-213.

Geology and mineralogy of Tsumeb deposits in Southwest Africa; extraction cycles employed in U. S., Belgium, Italy and Katanga; atomic structure and behavior of Ge; techniques of preparation of semiconductor Ge monocrystals; applications. 18 ref. (A-general; Ge)

574-A.* **Metallurgy in Nuclear Engineering. Survey of the Literature in 1957. Pt. 2.** J. Burkett. *Metallurgia,* v. 58, Aug. 1958, p. 64-66.

Metallurgy of reactor fuels—thorium, uranium, uranium dioxide, plutonium; welding of materials for nuclear reactors. 68 ref.
(A-general, T11, 17-57; U, Th, Pu)

575-A.* **New Magnesium Alloys.** R. J. M. Payne and N. Bailey. *Metallurgia,* v. 58, Aug. 1958, p. 67-68.

Series of Mg alloys useful in both cast and wrought conditions. Known as the M.S.R. alloys, they contain Ag, rare earth metals and Zr, and have higher proof stress figures than existing Mg alloys.
(A-general, Q27; Mg-b)

576-A.* (Polish.) **Analysis of the World Trend of Expansion of Rolling Mills for Production of Welded Tubes.** Wladyslaw Dobrucki. *Hutnik,* v. 25, Apr-May 1958, p. 156-164.

World production of tubes and present trend of capital investment in the industry. Improvements of tube rolling mills; economical factors and policies influencing fast growth of the mills. 32 ref.
(A4p, W23h; ST)

577-A. **Working With Beryllium.** *Light Metal Age,* v. 16, Aug. 1958, p. 6-9.
(A7q; Be)

578-A. **New Air-Hardenable Steel Has 280,000 Psi. Tensile Strength.** *Machine Design,* v. 30, Sept. 18, 1958, p. 38-39.

Airsteel X-200 developed by U. S. Steel. (A-general, Q27a; ST)

579-A. **Plant Layout Case Studies.** *Metalworking Production,* v. 102, Aug. 15, 1958, p. 1419-1425.
(A5; 18-67)

580-A. (Czech.) **Planning of Metallurgical Transport.** Jan Polasek and Emanuel Zelinka. *Hutnické Listy,* v. 13, no. 7, 1958, p. 626-631.

Material transport considerations in choosing locations and laying out metallurgical plants. 5 ref.
(A5a, 18-51, 18-67)

581-A. (German.) **Lead and Zinc World Trends.** W. Macking. *Metall,* v. 12, Aug. 1958, p. 745-750.
(A-general; Pb, Zn)

582-A. (German.) **The U. S. Lead and Zinc Dilemma.** F. A. Pinkerneil. *Metall,* v. 12, Aug. 1958, p. 753-754.
(A4p; Pb, Zn)

583-A. (German.) **Over-Production of Lead and Zinc.** J. Vuillequez. *Metall,* v. 12, Aug. 1958, p. 755.
(A4p; Pb, Zn)

584-A. (German.) **Tariff Policies Concerning Lead, Zinc and Their Alloys.** H. J. Rathlein and H. Schatz. *Metall,* v. 12, Aug. 1958, p. 756-758.
(A4q; Pd, Zn)

585-A. (German.) **World Production of Berylium.** R. Kerschagl. *Metall,* v. 12, Aug. 1958, p. 762-763.
(A4p; Be)

586-A. (German.) **Decontamination and Neutralization of Industrial Waste.** Erich Lutter. *Metallwaren-Industrie und Galvanotechnik,* v. 49, July 1958, p. 280-297.

Problems encountered in filtering deposits containing Cr compounds. Comparison of different methods now being used. Importance of lowering cost of operation. 36 ref.
(A8b; Cr)

587-A. (German.) **Observations on Operational Practices in American Steel Mills. Pt. 1. Working Habits and Efficiency. Pt. 2. Differences in Organization Practice.** Werner Schütte and Helmut Spitzer. *Stahl und Eisen,* v. 78, June 26, 1958, p. 873-882.

Differences between German and American management and operation practice. 8 ref. (A5; ST)

588-A. (Japanese.) **Choice of Heat Resistant Steel.** Taro Hasegawa. *Metals,* v. 28, July 1958, p. 537-541.

General discussion of heat resisttant steel for gas turbines.
(A-general, W11m; SGA-h)

The subject coding at the end of the annotations refers to the ASM-SLA Metallurgical Literature Classification. International (Second) Edition, now available from A.S.M., 7301 Euclid Ave., Cleveland 3, Ohio.

589-A. (Portuguese.) **Present Possibilities for the Manufacture of Sponge Iron in Brazil.** Anchyes C. Lopes. *Engenharia, Mineracao e Metalurgia,* v. 28, July 1958, p. 15-17.

Several Brazilian steel producers could make competatively priced sponge iron using locally available raw materials and fuels. (A11, D8j)

590-A. (Russian.) **Utilization of Secondary Power Resources of the Metallurgical Industry.** V. D. Pashkov. *Stal',* v. 18, July 1958, p. 660-667.

Use of waste furnace gas for developing steam at 2.5 atm. pressure for use in openhearth cooling system; for developing steam at 3-5 atm. for boilers; for gas turbines to increase volume of compressed blast furnace gases. (A11c; Fe, EG-m44)

591-A. **Development of ZM41 Magnesium Sheet Alloy.** H. A. Johnson and R. D. Masteller. Wright Air Development Center. *U. S. Office of Technical Services,* PB 131417, Sept. 1957, 30 p. $.75.

Alloy system which appears superior to AZ31 has nominal composition of 4% Zn, 1% Mn, 0.7% mischmetal, balance Mg. ZM41 alloy, compared to AZ31, has higher strength, more uniform longitudinal and transverse tensile properties, and a much greater tolerance for iron without corrosion resistance being adversely affected.
(A-general, Q-general; Mg-b, 4-53)

592-A.* **New Titanium Alloys.** (Digest of "Titanium Alloys for Air and Spacecraft", Walter L. Finlay, M. B. Vordahl and R. F. Malone. Presented at Technical Forum, Crucible Steel Co. of America, Pittsburgh, June 26, 1958). *Metal Progess,* v. 74, Sept. 1958, p. 134, 136, 138, 140, 142, 145.

Comparative review of properties and application with special reference to B 120 VCA, C 120AV, C 115 AMoV, C 105VA, and C 135 AMo.
(A-general, Q-general, 17-57; Ti-b)

593-A.* (Russian.) **Physical-Chemical Properties and Fields of Application of Rare Metals.** E. M. Savitskii. *Metallovedenie i Obrabotka Metallov,* Aug. 1958, p. 2-13. (Henry Brutcher, Altadena, Calif., Translation no. 4311.)

Ten-fold increase in production of rare metals in recent years. Application to armaments, aviation, missiles and atomic energy. General review of light rare metals, infusible rare metals, dispersed rare metals, rare earth metals and radioactive rare metals. Application to machine building, chemical, radiotechnical and other branches of industry. 22 ref.
(A-general, 17-57; EG-g)

594-A.* **Constitution, Production and Mechanical Properties of Ni-Re-**

sist. R. Barton. *British Cast Iron Research Association, Journal,* v. 7, Aug. 1958, p. 299-315.

Constitution, composition, structure and physical and mechanical properties of Ni-Resist, austenitic cast iron. Cupola practice, foundry technique, machining speeds, corrosion resistance, typical applications. 10 ref. (A-general; CI-q; *Ni*)

595-A. Production Control Without Paperwork. *Canadian Metalworking,* v. 21, Sept. 1958, p. 16, 18.

Monitoring production of machinery units and subassembly line, new system records number of parts produced, the time involved and feeds this to centrally-located dispatch room. (A5; 18-74)

596-A. Chemistry and Metallurgy of Titanium. *Engineer,* v. 206, Aug. 29, 1958, p. 334-335.

Properties, applications and heat treatment. (A-general; Ti)

597-A. How Good Plant Layout Cuts Costs. J. L. Martin. *Iron Age,* v. 182, Sept. 25, 1958, p. 85-87.

(A5; 18-67)

598-A. Treat Flue Dust to Recover Iron. John Mitchell and A. C. Sediachek. *Iron Age,* v. 182, Sept. 25, 1958, p. 96-97.

Ferrocoke, a carbonized blend of coal and blast furnace flue dust, is an easy, practical, and technically feasible way to use flue dust. (A8a, A11d; Fe)

599-A. Air and Water Pollution in the Iron and Steel Industry. A. Parker. *Iron and Steel Institute. Journal,* v. 189, Aug. 1958, p. 297-302.

(A8a, A8b; ST)

600-A. Present and Future Uses of Titanium. Paul M. Tyler. *Metal Progress,* v. 74, Sept. 1958, p. 109-112, 170, 172, 174, 176, 178, 180, 182.

Ti sheet and forgings now cost so much that uses are restricted; 90% of American production goes into jet engines for the Air Force. In a mature industry with integrated plants, costs would be cut to one-fifth, thus opening large new markets in chemical equipment and wheeled vehicles. (A4s, 17-57; Ti)

601-A. Recent Statistics on Metallurgical Education. W. O. Philbrook. *Metal Progress,* v. 74, Sept. 1958, p. 113-114.

Nearly 10% more degrees in metallurgy were granted in 1957 than in 1956. The number of B.S. degrees fell just short of 600 but was up 9.5% over the previous year. Masters, with 176 degrees, were up 8%. Doctors totalled 83, up 9%. (A3g)

602-A. Silicon: Present and Future. Walter E. Remmers. *Modern Castings,* v. 34, Oct. 1958, p. 47-52.

Current and possible future applications of Si and Si compounds. (A-general; Si)

603-A. Standard for Production, Processing, Handling, and Storage of Titanium. *National Fire Protection Association,* NFPA no. 481, 1958, 32 p. $.50.

(A7, S22; Ti)

604-A. Arsenic. A. D. McMahon and Gertrude N. Greenspoon. *U. S. Bureau of Mines Minerals Yearbook, Preprint,* 1957, 6 p.

Production statistics and prices for 1957. (A4p; As)

605-A. Beryllium. Donald E. Eilertsen. *U. S. Bureau of Mines Minerals Yearbook, Preprint,* 1957, 7 p.

Production statistics and prices for 1957. 18 ref. (A4p; Be)

606-A. Bismuth. H. M. Callaway and Edith den Hartog. *U. S. Bureau of Mines Minerals Yearbook, Preprint,* 1957, 6 p.

Production statistics and prices for 1957. (A4p; Bi)

607-A. Cobalt. Hubert W. Davis and Charlotte R. Buck. *U. S. Bureau of Mines Minerals Yearbook, Preprint,* 1957, 13 p.

Production statistics and prices for 1957. 14 ref. (A4p; Co)

608-A. Columbium and Tantalum. William R. Barton. *U. S. Bureau of Mines Minerals Yearbook, Preprint,* 1957, 14 p.

Production statistics and prices for 1957. 49 ref. (A4p; Cb, Ta)

609-A. Lithium. Albert E. Schreck. *U. S. Bureau of Mines Minerals Yearbook, Preprint,* 1957, 7 p.

Production statistics and prices for 1957. 20 ref. (A4p; Li)

610-A. Magnesium. H. B. Comstock. *U. S. Bureau of Mines Minerals Yearbook, Preprint,* 1957, 9 p.

Production statistics and prices for 1957. (A4p; Mg)

611-A. Review of Metallurgical Technology. Earl T. Hayes. *U. S. Bureau of Mines Minerals Yearbook, Preprint,* 1957, 5 p.

(A-general, B-general, C-general)

612-A. Sodium and Sodium Compounds. Robert T. MacMillan and Annie L. Mattila. *U. S. Bureau of Mines Minerals Yearbook, Preprint,* 1957, 6 p.

Production statistics and prices for 1957. 19 ref. (A4p; Na)

613-A. (Russian.) **Hydraulic Removal of Waste Molding Sand.** A. A. Dudnik. *Liteinoe Proizvodstvo,* July 1958, p. 13-16.

Installation which simultaneously removes waste sand, purifies the air and cleans the water in cast iron foundry at a 50% reduction in cost. (A8d, W19h; CI)

614-A. (Russian.) **Installation for Dehydration of High-Viscosity Fuel Oils.** I. V. Belov, V. S. Ozhiganov and P. B. Shalaev. *Stal',* v. 18, Aug. 1958, p. 755-758.

(A11c; RM-k)

615-A. (Russian.) **Dehydration of Fuel Oil by Using Waste Heat of Flue Gases of Industrial Furnaces.** F. Z. Babuskin and D. Ya. Feiderov. *Stal',* v. 18, Aug. 1958, p. 753-755.

(A11c; RM-k)

616-A. The Role of Thorium in the Nuclear Field. John P. Howe. Paper from "The Metal Thorium", American Society for Metals, 1958, p. 1-19.

Nuclear reactions connected with the use of Th; reactor types which can use the material; mode of use in these reactors; requirements and processing of Th-base components; economic factors. 11 ref. (A-general, T11g; Th)

617-A. Hazards Associated With Thorium Metallurgy. A. F. Voigt. Paper from "The Metal Thorium", American Society for Metals, 1958, p. 296-315.

Sources of potential danger confronting personnel who handle Th through metallurgical operations are chemical toxicity, radiological toxicity and fire and explosion hazards. Maximum permissible levels for Th concentration in air. 18 ref. (A7; Th)

618-A. (Pamphlet.) **Charting Steel's Progress.** 69 p. 1958. American Iron and Steel Institute, 150 E. 42nd St., New York 17, N. Y.

Statistical summary of materials, capacity, growth, distribution, wages and working conditions relating to the steel industry in 1957. (A4b)

619-A.* (Book.) **Beryllium Copper.** Copper Development Association, Publication no. 54, 55 South Audley St., London, W. 1, England. 1958. 61 p.

Physical and mechanical properties, resistance to corrosion, foundry practice, working, machining, joining, applications, safe handling. The alloys' strength, hardness and corrosion resistance recommend application as springs, dies, welding electrodes and nonsparking tools. 70 ref. (A-general; Cu-b, *Be*)

620-A. (Book.) **The Metal Thorium.** 397 p. 1958. American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio. $10.

Proceedings of the Conference on Thorium held Oct. 11, 1956, at Cleveland, under joint sponsorship of A.E.C. and A.S.M. Papers abstracted separately. (A-general; Th)

621-A. (Book-German.) **Gmelins Handbook of Inorganic Chemistry. Germanium. 8th Ed. System 45. Supplement.** 576 p. 1958. Verlag Chemie, GmbH. Weinheim/Bergstrasse, West Germany. $79.68.

Research for the period 1931-1953. Recovery, refinement and properties, with emphasis on semiconductor applications. (A-general; Ge)

622-A. (Book-German.) **Gmelins Handbook of Inorganic Chemistry. Hafnium. 8th Ed. System 43. Supplement.** 23 p. 1958. Verlag Chemie, GmbH. Weinheim/Bergstrasse, West Germany.

Geochemistry, separation properties. (A-general; Hf)

623-A. (Book-German.)**Gmelins Handbook of Inorganic Chemistry. Zirconium. 8th Ed. System 42.** 448 p. 1958. Verlag Chemie, GmbH. Weinheim/Bergstrasse, West Germany. $63.84.

Historical review, recovery, properties, applications. (A-general; Zr)

B Ore and Raw Material Preparation

209-B.* Magnetic Separation. Basic Principles and Their Practical Application. P. M. Sheahan. *Australasian Institute of Mining and Metallurgy, Proceedings,* no. 186, June 1958, p. 135-159.

A system of dynamics is postulated and the forces operating are examined, together with a method of evaluating the effect of operating variables. (B14j)

210-B.* (English.) **A Contribution to the Hydrometallurgy of Egyptian Zinc-Lead Ores. Pt. 1. Composition of Representative Samples From the Ore Body at Um Gheig.** A. R. Tourky and M. Y. Farah. *Egyptian Journal of Chemistry,* v. 1, no. 1, 1958, p. 137-146.

Sixteen samples of Um Gheig (Red Sea) smithsonite, galena and cerrusite ore were found to be of 22.9% and 4.01% Zn and Pb content respectively. Hand sorted specimens contained 45% Zn, 2-3% Pb, 17% silica and 6% CO_2. Trace metals are As, mainly from wulfen-

(*)Articles Available Through Photocopy Service; See Coupon, p. 75.

ite minerals, Mo, Cd, Ge. Water samples from the Um Gheig mine, and a well 100 miles north, are analyzed. 8 ref. (B11, A4n; Zn, Pb)

211-B.* (English.) **A Contribution to the Hydrometallurgy of Egyptian Zinc-Lead Ores. Pt. 2. Variation in Composition at Different Particle Sizes.** A. R. Tourky and M. Y. Farah. *Egyptian Journal of Chemistry,* v. 1, no. 1, 1958, p. 147-152.

Varying content of Zn, Pb, SiO_2 arsenites and chlorides of ore grains ranging in size between +10 and −200 mesh studied to find right sizes for leaching and flotation. No remarkable change of Zn and Pb content in sizes above 500 microns; accentuated increase in sizes less than approximately 100 microns. No variation of chloride content with size. In general, arsenites and silica increase with smaller sizes. (B14h, C19n; Zn, Pb)

212-B.* (German.) **Zirconium-Cristobalite, a New Acid-Type Furnace Lining for the Steel Industry.** Eduard Steinhoff. *Stahl und Eisen,* v. 78, June 26, 1958, p. 893-899.

Above 1700° C. conventional linings of quarzite are short lived. Quartz-zirconium linings proved to be better in temperature resistance. Softening takes place at a load of 2 kg. per sq. mm. only between 1730 and 1780° C. Life of linings was increased 4 to 5 times. In the surface of the bricks a concentration of zirconium oxide was observed providing a high-viscosity protective layer. 11 ref. (B19d, D1, D2; ST, RM-h)

213-B. Modern Developments in Steelworks Gas Producer Practice. J. C. Martin. *Birmingham Metallurgical Society, Journal,* v. 38, June 1958, p. 76-81.

Recent developments in control of air stream and coal feeds in production of producer gas for openhearth furnaces. Gas cleaning methods. 6 ref. (B25, D2)

214-B. (French.) **Investigation of Causes of Al_2O_3 Losses During Alumina Production by the Bayer Method.** E. Magyarosy, M. Mariassy and A. Perczel. *Acta Technica,* v. 21, no. 3-4, 1958, p. 275-288.

Examination of hydrolysis in the aluminate solution using the Bayer method; reaction times in the solutions in contact with the red mud and effect of contamination of the solutions on hydrolytic decomposition. 7 ref. (B14; Al)

215-B.* (German.) **Reduction of Coke Consumption and Increased Pig Iron Output Throught Iron Ore Beneficiation.** Robert Mintrop. *Stahl und Eisen,* v. 78, May 15, 1958, p. 633-646.

Various methods for preparing iron ore burden so as to increase capacity of existing blast furnaces and reduce coke consumption. Sizing, sintering, enriching of iron ore from the Minette area, the Midlands, Sweden and the U. S. Extensive test results recorded in diagrams showing coke consumption in relation to percent of sintered ore in the burden, blast temperatures and pressures, flow resistance in relation to pellet size and percent Fe in ore or sinter. 30 ref. (B13, B14, B16; Fe)

216-B.* **Experience With Sinter Burden in Swedish Blast Furnaces.** Ulf Notini. *Iron and Steel Institute, Journal,* v. 189, Aug. 1958, p. 322-326.

Coke consumption reduced by 20 to 25% with sinter because of its improved reducibility and a fusion zone rich in iron and higher blast temperatures. Self-fluxing sinter gave coke saving of 10 to 15%. Increased output as much as 250% for charcoal furnaces and 100% for coke blast furnaces. Use of sinters sometimes increased tendency for charge to hang leading to slips. (B16a, D1a; Fe)

217-B.* (Russian.) **Pelletizing Iron Ores and Concentrates.** N. A. Yarkho. *Metallurg,* v. 3, Aug. 1958, p. 3-8.

Advantages of pelletizing over agglomeration of ores: greater gas permeability; more readily reduced; greater mechanical strength; easier to transport. Most effective method of pelletizing is preliminary compression of the ore under vacuum and then placing in drums and roasting. This results in stronger, more uniform lumps. A chemical-catalyst method is used to enrich lumps with carbon and flux, and $CaCO_3$. (B16b; Fe)

218-B. Sintering: 5000 Tons a Day. *Metal Progress,* v. 74, Sept. 1958, p. 74-77.

U. S. Steel's new sintering plant is virtually automatic in operation. The strong porous cake provides a more effective blast furnace burden. Furthermore, the ore supply is indirectly increased because fines formerly lost are used to make the sinter. (B16a, D1; Fe)

219-B. Factors Influencing Flotation in Tin Ore Dressing. *Mining Journal,* v. 251, Aug. 29, 1958, p. 222-223.

4 ref. (B14h; Sn)

Extraction and Refining

290-C.* **Electrorefining of Titanium From Binary Alloys.** J. R. Nettle, T. E. Hill, Jr., and D. H. Baker, Jr. *U. S. Bureau of Mines, Report of Investigations 5410,* 1958, 11 p.

Seven alloys of Ti with 5% Mn, V, Al, Cr, Sn, Zr and Mo examined to determine efficiency of Ti separation under controlled conditions. (C23p; Ti)

291-C.* (German.) **Maximum Oxidation of Antimony in the Dry Lead Refining Process.** Joachim Barthel. *Freiberger Forschungshefte,* no. B28, June 15, 1957, p. 36-39.

Research results show that maximum oxidation of Sb in Pb is dependent upon high degree of oxidation of Sb_2O_3, which is a function of Sb content in metal phase, temperature and solubility. (C28j; Pb, Sb)

292-C.* (German.) **Cadmium Precipitation From Solutions Obtained From Leaching Zinc Ores.** Klaus Hein. *Freiberger Forschungshefte,* no. B28, June 15, 1957, p. 40-41.

During Cd ion oxidation-reduction process in Zn electrolytes in the presence of Cu, an accelerating and a retarding reaction occur. Accelerating effect is due to increased adsorption of Cd ions on activated Cu-Zn surface; retarding effect is caused by metals with low, irreversible hydrogen potential (Cu, Ag) which repress Cd precipitation due to increasing hydrogen evolution. Metals with high irrversible hydrogen potential (Sn, Hg, Cd) have a small retarding effect on speed of Cd reduction. Metals which either accelerate or retard Cd precipitation process can therefore be predicted. (C23; Cd, Zn)

293-C. (Polish.) **Mechanism of the Cathode Process in the Metallurgy of Aluminum.** Leszek Suskiy. *Wiadomosci Chemiczne,* v. 10, no. 3, 1956, p. 141-159.

Theoretical bases of electrolytic production of Al with special reference to the mechanism of the cathode process. It is not established definitely whether Al is extracted during an electrode reaction directly or the extraction is due to some secondary processes. (C23p; Al)

294-C.* **Preparation of Titanium-Aluminum Alloys by Alumino-Thermic Reduction. Pt. 2. By Use of Energisers.** R. A. Sharma, A. N. Kapoor and A. B. Chatterjea. *Indian Institute of Metals, Transactions,* v. 11, June 1958, p. 89-99.

Energizers such as barium peroxide or potassium chlorate were utilized to produce higher temperatures and to increase the Ti content in the alloy. Amount of energizer necessary to obtain suitable temperature (2200° C.) was calculated. Variation of aluminum and barium peroxide additions, and admixture of various amounts of calcium oxide and of the particle size of the Al and rutile were studied to ascertain the optimum conditions for the reduction of rutile. 6 ref. (C26; Ti, *Al*)

295-C.* **Studies on Vanadium and Titanium Bearing Iron Ore of Mayurbhanj.** R. K. Mitra and G. P. Chatterjee. *Indian Institute of Metals, Transactions,* v. 9, 1955-1956, p. 111-121.

Mineral described contains about 60% Fe, 13.6% TiO_2; 2.3% SiO_2 and other insolubles; 1.26% V_2O_5 and traces of P and S. Magnetic separation at different grades was resorted to followed by mineralogical examination of the fraction thus obtained. Reduction treatments of the ore in the solid state by coal gas and also by finely powdered charcoal at 950 and 1050° C. were studied. Reduction by gas at 1050° C. was found most suitable. (C26, B14j; Fe, *V, Ti*)

296-C.* **Preparation and Electrolysis of Titanium Trichloride.** H. N. Sinha and H. K. Worner. *Indian Institute of Metals, Transactions,* v. 9, 1955-1956, p. 123-133.

Titanium trichloride can be electrolyzed in suitable molten salt mixtures to produce Ti. Method for preparing trichloride by reducing tetrachloride with hydrogen on a hot silica surface. The trichloride thus produced has been dissolved in a carrier electrolyte consisting of a eutectic of LiCl/KCl and electrolyzed at 550° C. to yield metal powder of purity and ductility comparing favorably with Kroll sponge. 24 ref. (C23p, H10b; Ti)

297-C.* **Production of Some Less Common Metals by Fused Salt Electrolysis.** R. K. Mangal and H. N. Sinha. *Indian Institute of Metals, Transactions,* v. 11, June 1958, p. 101-107.

Fused salt electrolysis offers good opportunities for the production of

Be, Th, U and Zr. Problems include: proper cell design because most of the baths have to be electrolyzed in an inert atmosphere; techniques of consolidating the metal crystals on the cathode; necessity of finding suitable refractory materials for the construction of the cell. 25 ref. (C23p; Be, Th, U, Zr)

298-C.* Electrolytic Recovery of Antimony From Battery Wastes. B. B. Dey, V. Aravamuthan and P. R. Rajagopalan. *Journal of Scientific and Industrial Research,* v. 17A, June 1958, p. 240-242.

The Pb-Sb alloy obtained by melting battery wastes is first subjected to electrorefining in a fluoborate bath to yield anode mud containing 85-90% Sb and 10-15% Pb. Electrolysis is carried out using Monel metal cathodes and graphite as anode. Deposits are bright, adherent and of high purity. (C23p, A11d; Sb, Pb)

299-C. (Russian.) **Reasons for Formation of Zinc Sponge Upon Cathodes of Zinc-Containing Electrolytes at Currents of Low Densities.** N. T. Kudryavtsev, R. Yu. Bek and I. F. Kushevich. *Trudy Moskovskogo Khimiko-Tekhnologicheskogo Instituta,* v. 22, 1956, p. 137-142.

Mechanism of Zn-sponge formation on a cathode, at low current densities, in Zn-containing electrolytes and, in particular, the part played by anodes and ions of nobler metals and oxidizing agents. When electrolysis is carried on with insoluble anodes (Pt and Ni) the sponge is formed only at the upper part of cathode near the boundary of the electrolyte with air; when electrolysis is carried on with Zn anode the sponge is formed over the whole surface. (C23; Zn)

300-C. (Russian.) **Electrolysis of Melted Manganese Slag.** O. A. Yesin, G. A. Toporishchev and P. M. Shurygin. *Izvestiia Akademii Nauk SSSR, Otdelenie Tekhnicheskikh Nauk,* no. 5, 1957, p. 85-91.

Electrolysis of melts of MnO-SiO_2, MnO-CaO-SiO_2 and MnO-Fe-Si_2 were studied in a magnesite cell with a cathode of Ag or Fe-Mn alloy and a graphite anode at 1250 to 1500° C. Faraday's law is valid for both electrodes at the optimum parameters of the process. (C23; Mn, RM-q)

301-C. A New Approach to the Synthesis of Metallic Hydrides. S. Ramamurthy. *Indian Institute of Metals, Transactions,* v. 11, June 1958, p. 81-88.

Gravimetric, vacuum dissociation and metallographic data indicate that a complex titanium-aluminum hydride ($TiH_2.3AlH_3$) is formed when a Sn-Al-Ti alloy powder is treated in hydrogen. 5 ref. (C19; Ti, Al, Sn)

302-C. Electron Beam Melting. *Metal Industry,* v. 93, Aug. 29, 1958, p. 176.

Heat for melting is supplied by an electron gun which serves as the cathode and bombards the melt stock (the anode) with electrons, heating it to the melting point. Molten metal drops into a water-cooled Cu crucible below. Ta, Mo and other metals have been produced of higher purity than ever known before. (C5; Ti, Ta, Zr, Mo)

303-C. A Rationale for the Recovery of Irradiated Uranium and Thorium by Solvent Extraction. T. H. Siddall. *Second United Nations International Conference on the Peaceful Uses of Atomic Energy.* A/CONF.15/P/521 U. S. A., June 1958, 24 p.

4 ref. (C19n; U, Th, 14-70)

304-C.* Production of Thorium Compounds. J. J. Barghusen and M. Smutz. Paper from "The Metal Thorium", American Society for Metals, 1958, p. 54-69.

Principal methods for the recovery of Th from monazite, including the Ames monazite, the Battelle and the Brazilian processes. Alternative methods outlined are separation by precipitation, liquid-liquid extraction, ion-exchange, and electrolysis. 23 ref. (C-general; Th)

305-C.* Preparation of Thorium Oxide and Thorium Fluoride From Thorium Nitrate. Ray W. Fisher. Paper from "The Metal Thorium", American Society for Metals, 1958, p. 70-77.

Operating technique used in the digestion of thorium nitrate and the precipitation and filtration of thorium oxalate; calcination of thorium oxalate; hydrofluorination of thorium oxide. (C19; Th)

306-C.* Development of the Thorium Tetra-Fluoride-Calcium Process for Thorium Metal. H. A. Wilhelm. Paper from "The Metal Thorium", American Society for Metals, 1958, p. 78-103.

Main reactants are thorium tetrafluoride and calcium, and the charge contains an additive which brings about the formation and separation of the metal in massive form as the product of the reduction step. A subsequent melting and casting operation is employed to obtain Th ingots for fabrication into useful shapes. (C1p; Th)

307-C.* Consumable-Electrode Arc Melting of Thorium. A. H. Roberson and Robert A. Beall. Paper from "The Metal Thorium", American Society for Metals, 1958, p. 114-123.

Consumable-electrode cold mold arc melting is an efficient method for preparing sound, homogeneous ingots for extrusion or forging from Ti sponge or electrolytic powder. Electrodes may be formed by cutting sponge into suitable shapes and welding them into suitable sizes, or by pressing the sponge into briquets that later are joined by welding. Th powder compresses into electrodes which usually require vacuum sintering to remove adsorbed gases. (C5h; Th)

308-C.* Direct Smelting of the Rich Sulfide Ore of Lead With Pyrite Cinder and Coke. Pt. 1. Tatsuo Matsukawa and Seiji Tokumoto. *Osaka University, Technology Reports,* v. 7, Oct. 1957, p. 399-402.

Lead sulphide ores smelted with pyrite cinder, coke and lime in muffle furnace. The sponge iron produced by the reduction acts as a desulphurizing agent. Yield of Pb is about 77%. 4 ref. (C21; Pb)

309-C. Principles Underlying New Highly Productive Methods of "Complex" Chemical Treatment of Polymetallic Iron Ores. D. P. Bogatsky and G. G. Urazov. *Academy of Sciences of the USSR, Bulletin,* no. 8, 1957, p. 933-941.

Simple and effective methods proposed for chemical refinement and treatment based on theoretical scheme of reduction-oxidation-reduction. 11 ref. (C19; Fe)

310-C. Avonmouth Zinc Blast Furnace Demonstrates Its Versatility. S. W. K. Morgan and S. E. Woods. *Engineering and Mining Journal,* v. 159, Sept. 1958, p. 95-99. (C21a; Zn)

311-C. Liquid-Liquid Extraction of Uranium From Aqueous Solutions. E. H. Crabtree and C. J. Lewis. *Engineering and Mining Journal,* v. 159, Sept. 1958, p. 102-108. (C19s; U)

312-C. Preparation of Iodide Thorium. N. D. Veigel, E. M. Sherwood and I. E. Campbell. Paper from "The Metal Thorium", American Society for Metals, 1958, p. 104-113.

The relatively low as-deposited strength of iodide thorium places a limitation on the size of the crystal bars that can be produced. Large-diameter starting filaments will be required for production of large-diameter crystal bar unless conditions can be established for the formation of more coherent deposits. (C1p; Th)

313-C. Electrolytic Refining of Thorium. Robert A. Noland. Paper from "The Metal Thorium", American Society for Metals, 1958, p. 124-132.

Purified product was deposited as a mass of discrete crystals on a Mo cathode. (C23; Th)

D Iron and Steelmaking

443-D.* (German.) **Studies on Flow in Openhearth Furnace Regenerators With a Laboratory Model.** Michael Hansen. *Stahl und Eisen,* v. 78, June 12, 1958, p. 804-812.

An air current was led into a model checker chamber and the influence of different ratios of inside dimensions of distribution to main inside dimensions of checkerwork studied. Effects of a collection main leading in the same direction as the distribution main and a collection main leading in inverse direction. Placing the checker chamber under the superstructure of the furnace allows a flow parallel to a vertical plane within the distribution main and the checker chamber. (D2, S18q, W18r)

444-D.* Some Observations on the Slag Metal Equilibria Involved in Ferromanganese Production. N. J. Wadia, V. G. Paranjpe and S. Visvanathan. *Indian Institute of Metals, Transactions,* v. 9, 1955-1956, p. 83-109.

Slag-metal equilibria in Mn-rich burdens were investigated to ascertain the effects of Mn content of the metal, slag composition and basicity, and temperature on the Mn and S distribution coefficients. The desulphurization reaction in Mn burdens follows the same pattern as in ironmaking, with the exception that the slags have a higher sulphur-bearing capacity owing to the formation of manganese sulphide. 28 ref. (D11n; Mn, Fe, AD-n)

445-D.* Desulphurization of Alloys in Hydrogen. B. Chatterjee and K. R. Sangameswaran. *Indian Institute of Metals, Transactions,* v. 9, 1955-1956, p. 161-165.

Studies of removal of sulphur from powdered samples prepared from two specimens of cast iron and from fine drillings prepared

(*)Articles Available Through Photocopy Service; See Coupon, p. 75.

from two samples of steel on heating for varying periods of time at 1000° C. in a current of dry hydrogen and in hydrogen containing 1.2% by volume of moisture. Moist hydrogen is more effective than dry hydrogen. 6 ref. (D11n; *S, H*)

446-D.* Direct Reduction of Iron Ore to Yield Usable Steel. Jatinder Mohan, P. K. Gupte and B. R. Nijhawan. *Indian Institute of Metals, Transactions,* v. 9, 1955-1956, p. 247-262.

Crushed iron ore, dried and ground preferably finer than 70 mesh, is packed in a paper tube and embedded in solid charcoal in a sealed steel canister. The canister is heated to the reduction temperature and then raised to a sintering temperature of the order of 1100° C. for several hours depending on the carbon content required in the steel. A fairly compact steel bar is obtained after reduction which lends itself readily to hot working. 6 ref. (D8j; ST)

447-D.* Continuous Casting of Steel. V. Yavoisky and P. K. Sen. *Indian Institute of Metals, Transactions,* v. 11, June 1958, p. 27-56.

Advantages of continuous casting of steel over normal casting practice. Thermal loss in the process, and heat exchange in the ingot, both in the primary stage of solidification in the water-cooled mold, and in the subsequent stage of complete solidification outside the mold. Characteristics of the crystalline structure govern the nature of inside and outside defects of the ingots. 11 ref. (D9q, N12; ST)

448-D.* Continuous Casting at Barrow. I. M. D. Halliday. *Iron and Steel,* v. 31, Aug. 1958, p. 417-419.

Features of ladles, tun dish, mold and mold operation in the continuous casting of steel billets. Operational procedure, performance data and billet quality. (D9q)

449-D.* Kaldo Process. Bo Kalling and Folke Johansson. *Iron and Steel,* v. 31, Aug. 1958, p. 419-423.

Advantages of rotating vessel and oxygen lance; hot metal and product analysis; cooling ore additions, exhaust gas cleaning, fuel economy, steel yield, blowing time, steel impact resistance and production rate of Kaldo furnaces in refining low and high-phosphorus pig irons; life of furnace lining. (D10b)

450-D.* Stirring in Steel Production. Mechanical and Inductive Stirring in the Arc Furnace. Arne Faerden. *Metallurgia,* v. 58, Aug. 1958, p. 57-63.

Both methods increase the speed of the reaction between steel and slag and thus improve deoxidation and desulphurization. Since the inductive method gives continuous stirring, it will undoubtedly effect more speedy refining under some conditions than can be obtained by mechanical stirring under those same conditions. Reference is also made to blowing gases or metallic vapors through the melt, reladling and rotating the furnace. 33 ref. (D5f)

451-D.* (French.) **Pretreatment of Lorraine Ores and Blast Furnace Performance.** Ch. G. Thibaut. *Revue de Metallurgie,* v. 55, June 1958, p. 513-522.

From analysis of performances of a large number of blast furnaces, a method is derived for calculating burden, coke rate and top gas composition. Method is applied to operations using self-fluxing Lorraine ores in different stages of preparation (run-of-mine condition, crushed and sized, totally sintered, and combinations of these). Thermal balance is determined for each case. 8 ref. (D1, B-general; Fe)

452-D.* (Czech.) **Deoxidation and Alloying of Steel for Very Heavy Ingots.** Alexander Dekanovsky. *Hutnicke Listy,* v. 13, no. 7, 1958, p. 577-586.

Method includes separate production of deoxidizing and alloying pre-alloy in a small oil or electric furnace, pouring the pre-alloy into tilting openhearth furnace or possibly a ladle. Preliminary oxidation with silico manganese in the furnace. (D2c; ST, 5-59)

453-D.* (German.) **Linz-Donawitz Process With Pig Irons of High Phosphorus Content.** Herbert Trenkler and Rudolf Rinesch. *Stahl und Eisen,* v. 78, June 26, 1958, p. 883-890.

Pilot operations in a 30-ton crucible to determine feasibility of processing pig iron up to 1.5% P in converters with the L-D process. Two slags are required, the first bringing P content down to 0.5% and leaving carbon content at 1.5 to 2%. An early slag formation is desirable and fine ores are added at the end of the first period. The second period is the same as with low P contents. To separate slag and steel properly a tap was built into the top of the crucible. The blasting process takes 12 min. more than on normal pig iron. Information on the Phoenix-Lance (PL) blasting process. 13 ref. (D10a; CI-a, *P*)

454-D.* (Polish.) **Analysis of Repair Costs and Analysis of Production Indicators of Basic Openhearth Furnaces With Silicate and Chromite-Magnesite Roofs.** Wladyslaw Hansel. *Hutnik,* v. 25, Apr-May 1958, p. 142-156.

Comparison of refractories consumption, repair time and repair costs. Graphs of durability of silicate and chromite-magnesite roofs. Influence of introduction of chromite-magnesite roofs upon steel output. 3 ref. (D2, W18r, 18-72; RM-h)

455-D. Piping and Segregation. G. Reginald Bashforth. *British Steelmaker,* v. 24, Sept. 1958, p. 288-293.

Causes of piping and segregation in steel ingots. Value of various types of refractory hot tops. Good casting pit practice is of decisive importance. 7 ref. (D9k, D9p, 9-67, 9-69; ST)

456-D. Probe Key Melting Variables. P. M. Unterweiser. *Iron Age,* v. 182, Sept. 11, 1958, p. 165-168.

New facts on consumable arc remelting under vacuum. (D8m, T1f, 1-52; ST)

457-D. Can Ultrasonics Improve Steel Ingot Quality? P. M. Unterweiser. *Iron Age,* v. 182, Sept. 11, 1958, p. 178-180. (D9; 1-74; ST)

458-D.* New Process Yields Quality Pig—Small-Scale Direct Reduction of Iron Ore. Albert de Sy. *Iron Age,* v. 182, Sept. 18, 1958, p. 92-94.

Uses carbon as reducing element and electricity as energy source. On a pilot-plant scale, it produces both a high-grade pig iron and a quality carbon toolsteel. Intended for the reduction of Fe-rich ores with an Fe content of at least 65%. Except in special cases, it is not a tonnage steel process. Applications: small-scale production of pig iron, high-quality virgin Fe as base material for high-quality alloy steels, and special pig Fe for the production of ferritic nodular Fe. (D8j, 16-61; CI-a, TS)

459-D. Manufacture of Pig Iron and Steel in Czechoslovakia. Dr. Jaroslav Horak. *Czechoslovak Heavy Industry,* June 1958, p. 12-20. (D-general, W18, 1-55; CI-a, ST)

460-D. Czechoslovak Metallurgical Industry and Its Perspective. Josef Hlavacek. *Czechoslovak Heavy Industry,* June 1958, p. 7-11. (D-general, C-general, W18; Fe, Al, Ni)

461-D.* (German.) **Experimental Converter With Basic Refractory and Continuous Temperature Recording and Determination of End Points.** Wilhelm Anton Fischer and Manfred Wahlster. *Stahl und Eisen,* v. 78, May 15, 1958, p. 646-654.

Experimental basic converter for 250-kg. burden operates at same characteristics and under same conditions as large-scale converters. Experiments covered the sequence of reactions in basic bessemer pig iron inside furnace in relation to oxygen enrichment of blast, temperature, pig iron components and limestone charges. Behavior of C, P, Mn, Si and N. A thermocouple was used for determining the temperature. 21 ref. (D3f, 1-65; ST)

462-D.* (German.) **Application of Natural Gas Fuel in Openhearth Furnaces in Austria.** Friedrich Huber and Hans Mraz. *Stahl und Eisen,* v. 78, May 15, 1958, p. 654-657.

In oil heated openhearth furnaces 60 to 75% natural gas was used as fuel. Choice of a suitable burner, design of gas pressure regulating equipment and reversing mechanism. Influence of carburization upon furnace yield and economy of operation. A 25% carburization of the oil permits a considerable saving in compressed air, offsetting the slightly lower heating efficiency and warranting a fast amortization of additional equipment. 4 ref. (D22; RM-m35)

463-D.* Modified Wrought Iron Has Greatly Improved Corrosion Resistance. *Industrial Heating,* v. 25, Sept. 1958, p. 1788, 1790, 1792, 1794.

Wrought iron with improved physical and mechanical properties and greatly increased corrosion resistance due to modified composition. Extent of deoxidation of base metal is increased; phosphorous content is increased; more siliceous slag is added in processing. (D8h, R-general, 2-60; Fe-m)

464-D.* Process Adds Economy to Electric Furnace Smelting. *Iron Age,* v. 182, Oct. 9, 1958, p. 81-83.

New direct reduction process, with partial pre-reduction of ore before charging to furnace, is economically feasible. (D8j)

465-D.* Large Electric-Arc Furnace Steelmaking Experience in the U. S. A. A. C. Ogan and D. J. Carney. *Iron and Steel Institute, Journal,* v. 189, Aug. 1958, p. 307-314.

Trends and development in furnace design, refractories, transformer capacities, electrode regulator controls and other auxiliary equipment. Cold charge and hot metal operating practices for making carbon steel; alloy and stainless experience; operating data for produc-

tion of carbon steel. Economics of electric versus openhearth furnaces. 17 ref. (D5, W18s; ST)

466-D.* (German.) **Kinetics of the Steelmaking Process.** Ludwig von Bogdandy, Walther Dick and Ivan N. Stranski. *Archiv für das Eisenhüttenwesen,* v. 29, June 1958, p. 329-337.

Survey of theoretical knowledge of steelmaking in converters and openhearth furnaces. Experiments on decarburization and dephosphorization. Relations along the refractory and atmosphere boundaries and the velocity of phase transformation of nitrogen and carbon monoxide in liquid iron. 55 ref. (D11; ST)

467-D.* (German.) **Properties of Iron and Steel Melts in High Vacuum.** Wilhelm Anton Fischer and Alfred Hoffmann. *Archiv für das Eisenhüttenwesen,* v. 29, June 1958, p. 339-349.

On heats with 0.001 to 3.5% C the properties of iron in high vacuum (10^{-5} to 10^{-3}) were observed and the behavior of nonmetallic elements (N, H, P, As, S, C, O) and metallic impurities (Mn, Si, Cu, Mg, Ca, Al, Zr) was studied in relation to melting time and refractory material. Refractories were electromagnesia, electrocorundum, statistical zirconium oxide, calcium carbonate, lime and dolomite. 35 ref. (D8m; Fe, RM-h)

468-D.* (German.) **Plant Experiments on the Smelting of (African) Conakry-Ore. Pt. 2. Removal of Chromium by Supplying Pure Oxygen to the Melt.** Wilhelm Wolf, Wilhelm vor dem Esche, Otto Steinhauer and Helmut Wysocki. *Stahl und Eisen,* v. 78, Aug. 7, 1958, p. 1100-1107.

By supplying pure oxygen under the surface of a basic bessemer melt, the Cr content was reduced from 0.8% to 0.1%. Temperature regulated by adding partly deoxidized roll scale. Oxidation of elements present in Fe occurs in the sequence: Si, Mn, V, Cr. It is necessary to completely oxidize the Si and to rather completely oxidize the Mn, before Cr can be attacked. A certain amount of oxidation of C and P is inevitable. 8 ref. (D3, D11r; *Cr*)

469-D.* (Russian.) **Production of Fluxed Sinter From Kerch Iron Ores and Its Use in Blast Furnaces.** I. V. Raspopov, Ya. S. Gorbanev and D. V. Gulyga. *Stal',* v. 18, Aug. 1958, p. 676-682.

Use of Kamyshburun sinter in 'Azovstal' blast furnaces improved quality and reduced costs. Recommends better separation of sinter fines by screening at sintering plant and sharp reduction of the number of sinter reloadings during transportation and at plant. By charging blast furnace with 80% sinter and 20% iron ore with increased basicity to 0.6 resulted in a 6% increase in blast furnace productivity, an 8% reduction in unit expenditure of coke, a 10 ruble reduction in cost per ton of pig iron and a 32% decrease in limestone. (D1a, B16a; Fe)

470-D.* (Russian.) **Investigation of Descent of Burden Materials in Blast Furnace by Radioactive Indicators.** G. G. Lukashev, Ya. S. Gorbanev and L. D. Prikhod'ko. *Stal',* v. 18, Aug. 1958, p. 682-687.

Distribution speeds of burden over furnace cross section and along its height. Burden moves with minimum speed at periphery and maximum speed at the coke combustion zones near the tuyeres. Under given conditions materials can move with maximum speed at the axial part of furnace. Maximum speed is at the upper part—to 10 m. per hr. It slows down at the mid part to 4-5 m. and at the lower third to 3.5 m per hr. (D1a, 1-59)

471-D.* (Russian.) **Preliminary Refining of Pig Iron in Ladles by Injection of Steam-Oxygen Mixture.** Ya. A. Shneerov, A. G. Derfel' and A. G. Kotin. *Stal',* v. 18, Aug. 1958, p. 694-702.

Injection of steam-oxygen reduces Si, Mn, C and S, but does not reduce the P content. Introduction of oxidizing and slag-forming additions speeds oxidation and increases the pig iron temperature to a certain extent. There is a 0.15% loss of metal as result of steam-oxygen injection. 7 ref. (D1d, D1h)

472-D.* (Russian.) **Mass Production of Semi-Killed Steel for Manufacture of Mine Supports.** V. V. Leporskii, S. S. Petrov and V. M. Presnyakov. *Stal',* v. 18, Aug. 1958, p. 702-706.

Production of semikilled Si-free steel containing approximately 1.0% Mn, which equals in quality killed steel for mine supports, considerably increased the output of rolled steel due to the reduction in cropping in the blooming mill and improved performance in the openhearth. Production practice for semikilled steel is similar to that of rimming steel of ordinary quality. Most effective way of reducing semikilled steel is by addition of ferromanganese to furnace and to ladle. 4 ref. (D2, T28m, 17-57; ST-k)

473-D.* (Russian.) **Optimum Temperature Conditions for Melting Rimming Steel Using Phosphorus Iron.** A. S. Kharitonov and M. T. Bul'skii. *Stal',* v. 18, Aug. 1958, p. 706-709.

Rimming steel made in rotary openhearth furnace with charge containing 75% phosphorus iron with composition of 0.6% Si, 2.0% Mn, 1.6% P and 0.08% S. The starting temperature was between 1510 and 1590° and before reduction it rose to 1570-1640°. (D2; ST-d)

474-D.* **Modern Attacks on Iron Ores.** C. F. Hoffman. *Metal Progress,* v. 74, Sept. 1958, p. 67-70.

While direct reduction will be applied commercially in some locations it will not supplant the blast furnace, one of the most efficient metallurgical tools in use. To meet the increased future needs for more Fe, steel mills will strive for higher production from existing furnaces by means of technological improvements. With beneficiated raw materials and newly developed uses of oxygen and other techniques, production in the same size blast furnace used in 1940 can be increased 67%. (D1, D8, B16; Fe)

475-D.* (Russian.) **Refining of Iron in Ladle With Steam-Oxygen Mix.** Ya. A. Shneerov, A. G. Derfel' and A. G. Kotin. *Metallurg,* v. 3, Aug. 1958, p. 11-14.

To make the maximum use of oxygen the Azovstal' plant experimented with preliminary refining of pig iron with oxygen in the ladle. This lowers the Si content from 0.7 to 0.3% with a resultant 15% increase of openhearth productivity. To get the best results with oxygen-treated pig iron, it is necessary to substantially increase the proportion of pig within the over-all metal portion of the charge. At Azovstal', pig iron makes up 75% of the metal in the charge. Lowering Si content of charge makes possible a phosphate slag with increased content of P_2O_5. (D9m, D11r; CI-a)

476-D. Rare Earths Homogenize Ingots. W. G. Wilson. *Iron Age,* v. 182, Oct. 2, 1958, p. 78-79.

Summary of two Russian reports on effect of rare earths on sulphur content and rolling properties of low-carbon steel. (D9r, D11s, F23; CN-g, *S, EG-g*)

477-D. (Russian.) **Influence of the Order of Addition of Alloying Elements on Quality of Steels With Aluminum.** A. K. Petrov, V. K. Petrov and E. D. Mokhir. *Stal',* v. 18, Aug. 1958, p. 742-744.

Determination of the best order for addition of Al and V has sharply reduced the number of rejects caused by cleavage and stained heterogeneity. 6 ref. (D2c, D5c, D9m; ST, *Al, V,* AD-n)

E Foundry

711-E.* (French.) **Elimination of Microporosity in Defective Castings.** Louis Gascuel. *Pratique des Industries Mecaniques,* v. 44, June 1958, p. 164-165.

Procedure and equipment used in injection into holes of suitable substance, usually a synthetic resin, followed by heat treatment designed to provide adherence, mechanical strength and corrosion resistance to injected material. (E25q, 9-68)

712-E.* (German.) **Use of Chills in Casting.** J. Tanner. *Giesserei Praxis,* v. 12, June 25, 1958, p. 239-242.

Chill iron casting process is particularly adaptable to nonuniform thicknesses, high stress values, fine grain structures and hardness of Brinell 180-220 for component parts of machine tools. Chills are not preheated and are used repeatedly. They are treated with mixture of fuel alcohol, colophane and graphite powder before utilization to insure longevity. Examples include castings of 4 to 6 tons with wall thicknesses up to 80 mm. (E22r; CI)

713-E.* (German.) **Cooling System for Dried Quartz Sand.** Karl Haake. *Giessereitechnik,* v. 4, June 1958, p. 123-124.

Sand is oven-dried and a conveyor transports it to a cooling tower in which water is circulated. Inside is a zigzag pipe through which the sand slides. Temperature depends on outside air and cooling water temperatures. Temperature measurements at different times were: entering sand temperature 40 to 60° C.; final sand temperature 18 to 25° C. Capacity of the cooler is 900 liters per hr. The cooling tower uses 1800 liters per hr. of water at 15° C. (E18b)

714-E.* (German.) **Basic Technology of the Elimination of Micro-Porosity by Impregnation With the Thermosetting Epilox-Adhesive M 26.** H. Grosch and B. Hildebrand. *Fertigungstechnik,* v. 8, June 1958, p. 266-267.

Preparation and properties of the adhesive. Cleaning and degreasing of parts to be impregnated (e.g., pressure resistant castings). Im-

(*)Articles Available Through Photocopy Service; See Coupon, p. 75.

pregnating by simple infiltration, by pressure or vacuum, by a combination of pressure and vacuum, and by application of ultrasonics. Health protection. (E25q; NM-d30)

715-E.* (German.) **Sand Mold Casting of Magnesium Alloys.** Hans Haensch. *Giesserei Praxis,* v. 12, June 25, 1958, p. 235-239.

Mechanical properties of cast pieces depend on mold, filling capacity, mold construction, and type of sand and slab used. Adequate proportions of water, sulphur, flowers of sulphur, boric acid, and absence of burnables in Kaiserslautern sand assure desired quality in green-mold casting. Crush, color and X-ray tests conducted on ordinary and heat-treatable Mg alloys shed light on behavior of surface finish, grain formation, stress and piping of castings. Steel molds of special design produce required strength in cast structures. (E11; Mg-b)

716-E.* **Some Experiments on Methods of Production of Nodular Cast Iron.** S. N. Anant Narayan and S. Visvanathan. *Indian Institute of Metals, Transactions,* v. 9, 1955-1956, p. 136-141.

Effects of chloride additions, especially calcium and barium chlorides, to molten cast iron. Results are negative in that the graphite structure is not altered from the normal flaky type to the spherulitic variety. Various methods of adding the agents, experiments to try the feasibility of reducing the chlorides by Al and changes in the composition of the base iron met with no success. Concluded that the production of nodular cast iron by calcium chloride treatment is open to severe criticism. 17 ref. (E25q; CI-r)

717-E.* **Why and Where to Use Centrifugal Castings. Pt. 2. Nonferrous Castings.** John L. Everhart. *Materials in Design Engineering,* v. 48, Sept. 1958, p. 93-95.

Properties of some alloys used for centrifugal castings; properties of static and centrifugally cast Cu alloys compared; centrifugal castings of Ni, Monel, S-monel, H-monel, G-nickel, Si-Ni, Inconel and silicon Inconel. 4 ref. (E14, Q-general; Cu-b, Ni-b)

718-E.* **Effect of Temperature and Atmosphere on Iron-Silica Interface Reaction.** G. A. Colligan, L. H. Van Vlack and R. A. Flinn. *Modern Castings,* v. 34, Sept. 1958, p. 54-60.

Variables affecting the reaction are the compositions of metal and sand, pouring temperature and casting cooling rate, metal pressure and the mold atmosphere. Mechanism of mold attack analyzed. Severity dependent upon temperature, time and oxidation. 11 ref. (E11; 9-71, 2-61)

719-E.* **Reduction of Silica in Large Shell Molds.** L. H. Van Vlack, R. G. Wells and W. B. Pierce. *Modern Castings,* v. 34, Sept. 1958, p. 61-67.

Surface finish, porosity (as influenced by pouring temperature), section size, carbon content, alloy additions, mold composition. 44 ref. (E16c)

720-E. Sodium Silicates for the CO_2 Process. E. A. Lange and R. E. Morey. Naval Research Laboratory. *U. S. Office of Technical Services,* PB 131642, Apr. 1958, 19 p. $.50.

Sands mixed with sodium silicate solutions can be hardened by exposure to carbon dioxide in a matter of seconds. This is an important advantage over conventional methods requiring hours of baking time. Parameters which may be applied directly to the practical application of the CO_2 process. Strength characteristics of the sand mixture related to composition of the sodium silicate solution. Evaluation of such factors as mixing order, CO_2, flow rate and drying techniques. (E18p)

721-E.* (German.) **Formation of Pores and Blisters in Zinc Die Castings.** K. Ruttewit. *Metall,* v. 12, Aug. 1958, p. 713-721.

Prerequisite for a minimum of these defects is a properly pure Zr alloy. Remelting of rejected parts is therefore not advisable. Overheating of melt produces gas porosity. Use of tray risers to eliminate froth. Elimination of old nonmetallic crucibles to avoid penetration of fuel combustion gases through bottom. 46 ref. (E13; Zn, 9-68)

722-E.* (Swedish.) **Surface Roughness of Iron Castings From Sand Molds.** Olof Carlsson. *Gjuteriet,* v. 48, Aug. 1958, p. 111-115.

Surface tension of liquid iron, its contact angles with sand particles, size of pores in mold wall and the size of sand influence surface roughness. Percentages of powdered coal and dextrin not critical. Coal dust important, to avoid iron oxide that would cause contact angles near 0° and penetration of iron into sand rough surfaces. (E11, E18r; CI)

723-E. Casting Defects. J. R. Park. *Foundry Trade Journal,* v. 105, Aug. 28, 1958, p. 257-260.

Various defects, functions of metal and melting; sand and molding material; molding practice; patterns; design. (E11; 9-68, 9-69)

724-E. Design of Die-Castings. Pt. 8. Designing Die-Castings for Easy Finishing. H. K. Barton. *Metal Industry,* v. 93, Aug. 15, 1958, p. 136-138. (Conclusion.) (E13, L-general; 5-61, 17-51)

725-E. Some Aspects of Modern Aluminum Casting. L. Fletcher. *Metal Industry,* v. 93, Aug. 15, 1958, p. 129-132; Aug. 22, 1958, p. 149-151. (E13; Al)

726-E. What Is Preventive Maintenance? J. M. Abernath. *Modern Castings,* v. 34, Sept. 1958, p. 20-21.

Preventive maintenance defined and described from several standpoints. (E-general, W19, 18-71)

727-E. Centrifugal Pumps Prime Preventive Maintenance. Robert E. Jacoby. *Modern Castings,* v. 34, Sept. 1958, p. 24-25.

Pumps are key to auto foundry's sand reclamation system designed for minimum maintenance expense. (E18s)

728-E. Saving Through Preventive Maintenance. Chicago Hardware Foundry Co. S. A. Simonson. *Modern Castings,* v. 34, Sept. 1958, p. 26-28. (E-general, W19; 18-71)

729-E. Saving Through Preventive Maintenance. Electric Steel Foundry Co. Les Wittmayer. *Modern Castings,* v. 34, Sept. 1958, p. 29. (E-general, W19; 18-71)

730-E. Saving Through Preventive Maintenance. Stanton Iron Works Co., Ltd. J. I. Blackbourn. *Modern Castings,* v. 34, Sept. 1958, p. 30-34. (E-general, W19, 18-71)

731-E. Die and Permanent Mold Casting of Non-Ferrous Metals in the United Kingdom. L. J. Brice and G. A. Broughton. *Modern Castings,* v. 34, Sept. 1958, p. 68-81. (E12, E13; EG-a38)

732-E. Study of High Temperature Properties of Shell Molds. R. A. Rabe. *Modern Castings,* v. 34, Sept. 1958, p. 86-96.

Results of tests using bank sand, round and angular grain silica sand and 4-6% resin. Optimum composition and procedures. (E16c; 2-63)

733-E. Construction of Shell Mold Patterns and Core Boxes. Wayne A. Wright. *Modern Castings,* v. 34, Sept. 1958, p. 97-98. (E16c)

734-E.* (German.) **Improvements in the Mechanical Properties and Machinability of Cast Iron by Magnesium Treatment and Annealing.** Bruno Beyer and Hellmuth Seliger. *Giessereitechnik,* v. 4, July 1958, p. 153-158.

Three cast irons of almost the same percentage of C (2.98 to 3.35%) and Si (1.59 to 1.81%) but different P content (0.21 to 0.66%) are treated with Mg-Si-Fe alloy to add 0.2 to 0.3% Mg of heat weight. On annealing, the cementite decomposed in proportion to annealing time. Tensile strength and notch impact strength improved. Best machinability obtained with ferritic structure and no cementite. 17 ref. (E25, Q-general, G17k, 2-60, 2-64; CI)

735-E.* (German.) **Cupola Practice in the USSR.** L. M. Marienbach. *Giessereitechnik,* v. 4, July 1958, p. 159-161.

The problem of how to adapt cupola practice to high tapping temperature and continuous service. Current solutions such as increasing the radiation heat by high valve fuels (e.g., coke briquets) preheating the air blast and use of oxygen. 26 ref. (E10a)

736-E. (German.) **Economy by Exactly Dimensioned Precision Castings.** W. Schumacher. *Industrie Anzeiger,* v. 80, May 2, 1958, p. 519-520.

With precision cast small parts, finishing operations can be reduced to a minimum if the molds are formed very accurately. (E15, 17-53)

737-E. (German.) **Zinc Die Casting Is Advancing.** K. Baver. *Metall,* v. 12, Aug. 1958, p. 758-759.

Progress in Europe and U. S. Applications in the manufacture of nameplates, tail-light frames, small motor casings, electrical meters, etc. (E13, T-general, 17-57; Zn)

738-E.* **Melting Practice for Aluminum Casting Alloys.** William N. Brammer. *Modern Castings,* v. 34, Oct. 1958, p. 31-36.

Guide to casting techniques. 10 ref. (E-general; Al-b)

739-E.* **Cast Die Cavities. Pt. 3.** Irwin Lubalin. *Precision Metal Molding,* v. 16, Sept. 1958, p. 56.

Disadvantages of the Shaw process weighed against future prospects and growth. Offers rapid economical way of producing die-casting dies and replacement cavities as

well as trim dies and machining fixtures and offers possibility of vastly improved die life. (E13, W19n)

740-E. Investigation of Nodular Cast Iron Manufactured in the Springfield Armory Casting Laboratory. Olgierd Lubinkowski. U. S. Armory, Springfield, Mass. *U. S. Office of Technical Services,* PB 131399, May 1957, 45 p. $1.25.

Use of Mg-Si as inoculant in preparation of thin-wall, hypereutectic iron. Other addition agents, such as ferromanganese, tellurium, Lanceramp, and ferrosilicon evaluated for producing an iron with fully pearlitic structure and restricted carbide.
(E25q; CI-r, AD-p36)

741-E. Alloying and Heat Treatment of Ductile Cast Iron. Massachusetts Institute of Technology. *U. S. Office of Technical Services,* PB 131350, Aug. 1955, 97 p. $2.50.

Basic variables involved in risering ductile iron castings; effect on shrinkage. The amount of gross feed metal required depended upon carbon content, Si content, pouring temperature and rigidity of mold. Large sprues and flow-offs are sufficient to act as risers and feed the casting. Sponge shrinkage was eliminated by observing the following relationship. The % carbon + 1/7% silicon = 3.9%. Cutting of ductile iron; machining forces measured and analyzed.
(E22q, G17, J-general; CI-r)

742-E.* (German.) **Improved Cast Surfaces and Higher Production by the Use of Core Materials With Increased Flow Properties.** Ernst Wunderlich. *Giessereitechnik,* v. 4, July 1958, p. 169-172.

Good surfaces were obtained with cores made with oil binders and sands of grain sizes < 0.06 to < 0.3. This material suited for balanced cores up to 12 cm. in height, for cores made in jolting machines and for cores up to 15 cm. diameter. (E21g)

743-E.* (German.) **Processes for the Improvement of Various Properties of Cast Aluminum-Magnesium Alloys.** Hermann Kessler. *Zeitschrift für Metallkunde,* v. 49, June 1958, p. 312-316.

A new grain refining process for cast Al-Mg alloys was developed, introducing carbon chloride vapor into alloys containing Ti, B and Be by means of a carrier gas such as nitrogen. Through a reaction with carbon, titanium carbide and titanium diboride are formed which effect a particularly refined structure through the formation of nuclei. Chlorine gas in nascent state contributes to purification and degassing of melt. Yield strength, elongation, hardness, Charpy impact strength and fatigue strength are improved. (E25q, E25s; Al, Mg)

744-E.* (Russian.) **Vacuum Pressure Die Casting.** M. L. Zaslavskii. *Liteinoe Proizvodstvo,* July 1958, p. 6-8.

Application of vacuum pressure to eliminate porosity in castings has shown many other advantages. It provides stronger, cleaner surfaces and reduces waste by 15%. It has largely eliminated cracks in casting Mg alloys and increased strength of Zn alloy castings by 19%.
(E13, 1-73; Mg, Zn)

745-E.* (Russian.) **Nonferrous Metal casting in Plaster Molds.** V. G. Baradan'yants. *Liteinoe Proizvodstvo,* July 1958, p. 9-11.

Advantages of casting in plaster molds as against precision investment casting are that it can handle much larger thin-walled objects as well as parts with narrow cavities. It is necessary to use high-strength alpha-plaster which hardens slowly. Its preparation requires a 6 to 8-hr. treatment of calcium sulphuric acid in vapor at 1.2 to 1.3 atm. pressure followed by drying for 8 to 10 hr. at 120 to 124°. (E16a)

746-E.* (Russian.) **Hot Cracking Resistance of Cast Steel and Method of Increasing It.** N. S. Kreshchanovskii and M. P. Demin. *Liteinoe Proizvodstvo,* July 1958, p. 17-21.

Hot cracks form primarily at the crystal boundaries. The main factor determining the crack-resistance of steel is the character of the intercrystalline bonds which are determined by the substances entering into steel composition. Of particular importance is the surface activity of these elements. Admixtures which are introduced during the crystallization process, having the effect of reducing surface activity and increasing surface tension, will contribute to reducing hot cracks. Introduction of 3% Ti has proven to be most effective means of reducing surface activity and cracks. 30 ref.
(E25q, 19-72; ST, Ti, AD-p)

747-E.* (German.) **Gray Cast Iron and Steel Scrap.** J. Tanner. *Giesserei Praxis,* no. 15, Aug. 10, 1958, p. 291-293.

Steel scrap additions (up to 25%) improve quality and appearance of gray cast iron. Careful preparation (calculation of composition, analysis and mechanical tests) performed on steel scrap used.
(E11; ST, CI-n, RM-p)

748-E. Gas-Turbine Castings. P. V. Brown. *Aircraft Production,* v. 20, Sept. 1958, p. 337-342.

Recent developments in foundry techniques; use of epoxy resins in making pattern equipment.
(E17, W11n)

749-E. Improvement of Cast Iron by Oxygen Blowing. Ichiro Iitaka and Kokichi Nakamura. *Foundry Trade Journal,* v. 105, Sept. 11, 1958, p. 313-314.

Results of tests using oxygen injection as a substitute for steel scrap to lower Si and C content when making cast iron from remelted pig iron. (E25; CI)

750-E. Recent Developments in the Manufacture of Castings. J. L. Rice, R. W. Ruddle and P. A. Russell. *Institution of Mechanical Engineers, Proceedings,* v. 171, 1957, p. 133-160.
(E-general)

751-E. Casting or Forging? *Light Metals,* v. 21, Sept. 1958, p. 276-278.

Comparison of properties, costs, methods of casting and forging light metals. (E-general, F22; Al, Mg, Ti)

752-E. Frozen Mercury Investment Casting. *Mass Production,* v. 34, Sept. 1958, p. 92-98.

Mercast process has been introduced to England by Sankey-Telcon Ltd. (E15)

753-E. The Mercast Process. *Metal Industry,* v. 93, Aug. 1, 1958, p. 93-96.

Precision investment casting by the Mercast process, which uses frozen mercury as the pattern material. (E15)

754-E. We Cast the Impossible. R. H. Osbrink. *Modern Castings,* v. 34, Oct. 1958, p. 22-25.

High-precision light metal castings made by use of extreme care, high-quality cores and molds in Osbrink process. (E-general; Al, Mg)

755-E. Controlling C, H_2, O, N in Steel Melting. F. E. Van Voris. *Modern Castings,* v. 34, Oct. 1958, p. 28-30, 120-123.

Effect of various deoxidants, addition agents, and removal of common gases from molten steel. 16 ref. (E25s; ST, *O, N, H*)

756-E. Duplexing Pays at Automotive Foundry. H. A. Laforet and F. J. Webbere. *Modern Castings,* v. 34, Oct. 1958, p. 37-40.

Under favorable circumstances the duplexing of cylinder iron can show a net cost advantage if used to its full potential. Duplexing allowed major improvement in cupola practice and metal transfer operations.
(E10a, T21b; CI)

757-E. Aluminum Melting Practice in the Die Casting and Permanent Mold Fields. J. P. Moehling. *Modern Castings,* v. 34, Oct. 1958, p. 67-77.

General properties of Al, fluxing, porosity, melting furnaces.
(E13, E12; Al)

758-E. Sand Castings Are Expensive. *Precision Metal Molding,* v. 16, Sept. 1958, p. 55, 60.

Switching from a sand cast hinge to a permanent mold cast hinge resulted in a decrease in machining costs and weight, and reduced inspection costs, handling and rejects.
(E11, E12)

759-E. (Russian.) **New Foundries in Heavy Machinery Plants.** P. N. Bidulya. *Liteinoe Proizvodstvo,* July 1958, p. 1-2.

Installation of new mechanized foundry equipment has made it possible to turn out much larger castings while sharply reducing the cycle of production. Greater precision in casting parts has resulted in large savings of machining time. 6 ref. (E-general, W19, 18-74)

760-E. (Russian.) **Runner System Dimensions in Pressure Die Casting.** A. K. Belopukhov. *Liteinoe Proizvodstvo,* July 1958, p. 3-6.
6 ref. (E13, E22)

761-E. (Russian.) **Structure Formation at High Cooling Rate of Melt.** I. V. Salli. *Liteinoe Proizvodstvo,* July 1958, p. 22-25.

Decisive effect of speed of cooling on metal structure. Method of increasing cooling rate during crystallization of alloys. 8 ref.
(E25q, 2-61, 3-67)

762-E. (Book.) **Introduction to Foundry Technology.** D. C. Ekey and W. P. Winter. 296 p. 1958. McGraw-Hill Book Co., Inc., 330 West 42nd St., New York 36, N. Y. $7.

Foundry theory and practice for the engineering student.
(E-general)

F Primary Mechanical Working

282-F.* **Nomograms for Drawing Force and Power Consumption in Wire Drawing.** *Draht (English Edition),* no. 35, June 1958, p. 31-36.

Nomograms giving relationships between wire drawing variables enables rapid approximation of drawing force and power consumption

(*)Articles Available Through Photocopy Service; See Coupon, p. 75.

from values of plastic deformation, strength, reduction of cross-sections inlet or outlet diameter and drawing speed. 5 ref. (F28)

283-F.* (Czech.) **Working Life of Forging Dies.** Jiri Elfmark. *Hutnické Listy*, v. 13, no. 7, 1958, p. 612-620.

Effects of steel type, heat treatment, die design, forging temperatures, mill scale, die lubrication, die cooling and form of forging on die wear. Study of the life of dies made of CSN 19650 steel with varying degrees of die complexity indicates that greatest wear occurs on transition of form in burr and on projection edges. Welding wearing surfaces to prolong die life. (F22, W22a, Q9; ST)

284-F. Punch Cards Lead Drive to Automatic Mill Control. G. J. McManus. *Iron Age*, v. 182, Sept. 11, 1958, p. 169-171. (F23, W23, X14; 18-74)

285-F. Precision Forgings Minimize Machining. Alfred G. Jones. *Tool Engineer*, v. 41, Sept. 1958, p. 95-97.

Thermal resistant alloys require special tools, machines and methods to obtain the finishes required for aircraft. Precision forging of these alloys has reduced machining to a minimum since parts are forged to size with no excess stock. (F22; SGA-h)

286-F. (Russian.) **New Method of Determining Forgability of Metals.** D. I. Berezhkovskii. *Zavodskaya Laboratoriya*, v. 24, no. 7, 1958, p. 858-860. (F22, 17-52)

287-F.* (German.) **Metallurgical Principles in the Production of Copper Sheet.** Otto Nielsen. *Zeitschrift für Erzbergbau und Metallhüttenwesen*, v. 11, Aug. 1958, p. 355-360.

Importance of structural differences in cake types and copper grades in sheet production. Employment of proper atmospheres, temperatures and heating periods. Good practice in hot rolling, surface treatment and pickling. (F23; Cu, 4-53)

288-F. Effect of Temperature of Finish Forging on Properties of Forgings. I. G. Generson. *Metallovedenie i Obrabotka Metallov*, Aug. 1958, p. 46-51. (Henry Brutcher, Altadena, Calif., Translation no. 4322.)

Steel for turbine disks containing 0.45% C; 0.20% Si; 0.65% Mn; 0.96% Ni; 0.018% S and 0.022% P was melted in 10-ton basic electric furnace. As result of experiments changes have been made in heating procedure in many foundries. Temperature of finish forgings has been increased to 1050-1080° C. The starting temperature has been changed from 900 to 1250° C. Ingots are kept in furnace 2-3 hr. Change in heating procedure has increased productivity by 10-20%. (F22; AY)

289-F.* (Russian.) **Rolling Rail Steel From Heavy Ingots.** M. M. Gorenshtein and Z. A. Yashchenko. *Stal'*, v. 18, Aug. 1958, p. 711-715.

Experiments in rolling heavy ingots in 170-mm. blooming mill so as to define the effect of rolling rate on power characteristics and to develop an efficient schedule of reductions and rolling rates so as to secure maximum production at normal operating conditions without overheating motor. (F23, T23q; ST)

290-F.* (Russian.) **Production of Two-Layer Soldered Tubes.** P. K. Teterin and N. L. Klyamkin. *Stal'*, v. 18, Aug. 1958, p. 722-726.

Production of thin-walled two-layer tubes by soldering has many advantages over production by drawing. They can replace seamless steel tubes as well as copper and brass tubes with large saving of nonferrous metal. Their mechanical properties in every respect equal those of seamless steel tubes. (F26p, K7; ST)

291-F.* **Forging Blooms From Ingots.** John E. Decker. *Metal Progress*, v. 74, Sept. 1958, p. 71-73.

A short, heavily tapered ingot is forged after the piped zone is isolated from the sound steel by a punch. Tests show the blooms to be sound and free from segregation. (F22, D9k; ST, 4-52, 5-59)

292-F.* **Fabrication and Cladding of Thorium Metal.** J. E. Cunningham. Paper from "The Metal Thorium", American Society for Metals, 1958, p. 225-265.

Current status of technology for mechanically working thorium. Conversion of Th ingot into primary shapes by forging, rolling and extrusion, and working the metal by secondary operations such as swaging, drawing, cold finishing and machining. Techniques for preparing Al and Zr-clad Th products for reactor service. 24 ref. (F-general, L24; Th)

293-F.* (Russian.) **Mechanical Beveling of Rails.** V. V. Trofimov. *Metallurg*, v. 3, Aug. 1958, p. 29-31.

Changeover from manual to mechanical beveling made it possible to increase the working temperature from 550 to 750°. Beveling at higher temperatures reduces spoilage, rails emerge straighter after cooling off and their mechanical properties are improved. (F29; ST, 4-57)

294-F. Control Equations of Multistand Cold Rolling Mills. G. Lianis and Hugh Ford. *Institution of Mechanical Engineers, Proceedings*, v. 171, 1957, p. 757-776. (F23, 1-67)

295-F. Remote Control of Roll Screwdowns. *Iron and Coal Trades Review*, v. 177, Aug. 15, 1958, p. 371-376. (F23, W23n)

Secondary Mechanical Working

Forming and Machining

490-G. Machining and Fabricating High Strength Steels. Paul S. Kikeli and Francis Farago. Paper from "High Strength Steels for Aircraft", American Society for Metals, 1958, p. 41-51.

Problems include: unusually complex shapes which must be machined all over; a considerable portion of the machining must be performed after heat treatment to meet decarburization control requirements; materials being tempered on a production basis to a hardness never previously used for structural applications; extremely close tolerances for dimensional accuracy and surface finishes. (G17, T24; SS, SGB-a)

491-G. The Cold Roll-Forming Process—and as Applied to Semi-Austenitic Stainless Steels. Frank Jacobs. Paper from "Sheet Materials for High-Temperature Service", American Society for Metals, 1958, p. 51-68.

Cold roll-forming of 17-7 PH and PH 15-7 Mo stainless steel sheet and plate has been accomplished with reductions up to 65% in one pass of the roller. Cylindrical blanks machined from 17-7 PH bar stock were cold reduced up to 47.5%. Tensile properties which resulted from roll forming; effect of subsequent heat treatments upon the roll-formed material to develop additional strength in the formed part. 13 ref. (G11, SS)

492-G.* (German.) **Roll Spinning of Cone-Shaped Aluminum Parts. Pt. 2.** H. Reichel. *Fertigungstechnik*, v. 8, June 1958, p. 252-260.

Mathematical studies carried out with the help of an experimental machine to determine the values of the feeding force, measured axially, and of the reacting force, measured radially to the chuck. Relationship between these forces, the chuck and roll radii, the distance roll to chuck, roll velocity and feed. Feed limits determined, feeding and reacting forces varying with the thickness of material and its properties. (G13; Al)

493-G.* (German.) **Smoothing and Reworking of Center Bores With Cone-Shaped Grinding Tools.** Artur Schatz. *Werkstattstechnik und Maschinenbau*, v. 48, July 1958, p. 349-354.

Special grinding machines and operations for eliminating defects in center bores. Bores with minor defects are smoothed with grinding tools providing surface contact with the bore. Heavier imperfections are reworked by grinding with linear contact between tool and bore. In the latter case either the part is given a circular movement, leaving the spindle axis stationary, or the part stays at rest and the spindle axis describes a circular path. The grinding cone can be shaped by built-in devices. (G17d, 1-52)

494-G.* **Abrasive Cutting.** *Draht (English Edition)*, no. 35, June 1958, p. 28-31.

Advantages of abrasive cutting for parting wire rope, cable, rod, tube, sheet or plate. Cutting wheel selection, limitations on workpiece size; features of Swiss and German abrasive cutting machines. (G17; NM-j)

495-G.* **Some Experiments on the Impact Extrusion of Aluminum, Copper and Steel.** D. F. Galloway. *Machinery (London)*, v. 93, Aug. 13, 1958, p. 356-372.

Preparation of slugs, tools and equipment, variations of extrusion force with punch penetration, effect of wall thickness on extrusion force, effect of slug temperature and metal flow during reverse extrusion. (G5; Al, Cu, ST)

496-G. Precision Machines Slice and Dice Transistor Elements. Charles Emerson. *American Machinist*, v. 102, Sept. 8, 1958, p. 85-86.

High surface speeds and slow feeds allow precision cutting of small brittle crystals. Ultrasonic techniques also used for high accuracy. (G17k, G19, T1k; EG-j31)

497-G. How to Select and Apply Cutting Fluids. Antoni Niedzwiedski. *Canadian Machinery*, v. 69, Sept. 1958, p. 82-85.
(To be continued.) (Q17; NM-h)

498-G. Shot Peening and the Use of Steel Wire Slugs. Baurant W. Gesell. *Draht (English Edition)*, June 1958, p. 26-27.

Considerations governing use of steel wire slugs as peening media. Slug dimensions, properties, deformation and life.
(G23n, W2a; ST, 4-61)

499-G. Rocket-Engine Manufacture Requires Machining Ingenuity. Charles O. Herb and W. Edward Moller. *Machinery*, v. 65, Sept. 1958, p. 121-126.
(G17, T24b)

500-G. How Easily Can Honeycomb Structures Be Machined? R. G. Kellner. *Machinery*, v. 65, Sept. 1958, p. 132-137.
(G17; 7-59)

501-G. Pilots for Progressive Dies. Federico Strasser. *Machinery*, v. 65, Sept. 1958, p. 146-150.
(G3, W24n)

502-G. Smooth Finishes Obtained by Roller Burnishing. C. R. Morris. *Machinery (London)*, v. 93, Aug. 27, 1958, p. 471-472.

Internal and external finishes up to 5 micro-in. obtained by burnishing with carbide rollers in adapters mounted on standard vertical drills.
(G19r)

503-G. Equipment for the Economical Batch Machining of Large Parts. *Machinery (London)*, v. 93, Sept. 3, 1958, p. 525-529.
(G17; 1-62, W25)

504-G. Designing Metal Stampings. John L. Everhart. *Materials in Design Engineering*, v. 48, Sept. 1958, p. 109-124.

Blank layout, holes, bends, radii and tolerances; working characteristics of the metals most commonly used. (G3; 17-51)

505-G. Hobbing Extrusion Cuts Production Time. *Metalworking Production*, v. 102, Aug. 15, 1958, p. 1427-1429.

Production of intricate shapes in a single operation by hobbing or cold extrusion. (G5, G17b)

506-G. Which Cutting Fluid for Abrasive Belt Grinding? Hugh N. Dyer. *Metalworking Production*, v. 102, Aug. 22, 1958, p. 1469-1471.
(G18k; NM-h)

507-G. Stainless Honeycomb Electrolytically Ground. William G. Koehler. *Metalworking Production*, v. 102, Aug. 22, 1958, p. 1477-1479.
(G24d; 7-59; SS)

508-G. Ultrasonic Machining. *Product Engineering (Design Digest)*, v. 29, Sept. 1958, p. D12-D13.

Principles, handling methods, methods of feeding abrasives, effect of grit size on surface finishing, applications. (G24c)

509-G. (Italian.) **Coolants for Metalworking Operations.** Domenico Viotti and Angelo Albertocchi. *Ingegneria Meccanica*, v. 6, July 1957, p. 17-22.
(G17; NM-h)

510-G. (Italian.) **Plastic Working of Sheet Steel. Pt. 1. The Material.** Riccardo Levi. *Rivista di Meccanica*, June 7, 1958, p. 9-14.

Tests for determining physical properties of sheet; information tests provide on machinability; study of crystal structure for same purpose. (To be continued.)
(G17k; ST, 4-53)

511-G. (Russian.) **Simplified Method for Testing Broachability of Metals.** N. S. Kirvalidze and I. Yu. Korobochkin. *Zavodskaya Laboratoriya*, v. 24, no. 7, 1958, p. 850-854.

Method consists of determining critical point at which object, under pressure, forms cavity. 6 ref.
(G17k, 17-52)

512-G.* (English.) **Theoretical Investigation of Production of Gears by Hot Rolling.** I. Voros. *Acta Technica*, v. 21, no. 1-2, 1957, p. 47-78.

Equipment for hot rolling gears; device for drawing tooth profile; theoretical relationships and calculations involved in determining initial diameter of gear blank; deducing pressure angle of tool; determining tooth thickness at general sintered distances; finding dimensions of master gear tool and other determinations necessary for hot rolling gears; fatigue strength in hot rolled gears. (G11, T7a)

513-G.* (French.) **Manufacture of Test Pieces by Hydroforming.** T. C. Barrett. *Machine Moderne*, no. 592, July 1958, p. 31-34.

Blank is put on the support plate of the press, hydraulic chamber is lowered, rim of blank exposed to an initial pressure to avoid folding, punch moves up pressing the blank against rubber diaphragm of chamber, forming the part. (G14b)

514-G.* Sounding Brass. Pt. 2. *Welding and Metal Fabrication*, v. 26, Aug. 1958, p. 281-288.

Dimpling, bending, expanding, stretch-bending, shaping and other operations as performed on brass tubing in production of musical instruments. Bending and stretch-forming machines.
(G-general, T9r; Cu-n, 4-60)

515-G.* Cooling of Cutters by Heavy Pressure Stream. *Machine and Tool Blue Book*, v. 53, Oct. 1958, p. 104-111. (From *Mechanical Engineering News (Moscow)*, Dec. 1957.)

Analysis of the influence of different cooling methods on the durability of the tool under practical operating conditions. (G17; NM-h)

516-G.* Gun Drilling. Claude E. Sonday. *Machine and Tool Blue Book*, v. 53, Oct. 1958, p. 112-120, 122, 124.

Gun drilling is capable of producing deep holes, such as are required in artillery pieces and in aircraft hydraulic gear, with great speed and accuracy. It is applicable to most common materials. It is a form of boring. The gun drill is made with a single straight flute with the cutting edge limited to the forward tip. (To be continued.)
(G17d)

517-G.* How to Deplate a Rocket Engine or Rocket Engines Electrolytically Ground for Fast Metal Removal. E. A. Werner and William E. Hoffman. *Tooling and Production*, v. 24, Oct. 1958, p. 53-54.

A 300-amp. electrolytic power supply unit used on a DoAll G-10 surface grinder for grinding the "Christmas-tree" form of the root section on jet engine blades. It is now used on a lathe as an aid to overcome one of the difficult finishing problems created by a new rocket engine design. Besides the increased grinding rate, very significant savings accrue from the fact that the electrolytically ground surface is absolutely free from burrs or layover. (G18, G24d)

518-G. Only Pencil Outline Required for this Tracing System. *Canadian Metalworking*, v. 21, Sept. 1958, p. 34, 36, 38.
(G22g)

519-G. Tool Steel Bows to Deep Drawing. P. M. Unterweiser. *Iron Age*, v. 182, Sept. 18, 1958, p. 83-85.
(G4b; TS-b)

520-G. Reducing Electrode Wear in Spark Machining. Metalworking Production, v. 102, Sept. 12, 1958, p. 1608-1614.
(G24a)

521-G. Automatic Spinning of Titanium. Gilbert C. Close. *Modern Machine Shop*, v. 31, Oct. 1958, p. 108-115.

Machines and processes employed in making hot spun Ti hemispheres.
(G13; Ti)

522-G. Milling Applications Unlimited. Colin Sharp. *Modern Machine Shop*, v. 31, Oct. 1958, p. 136-140.
(G17b, W25r)

523-G. Research Into Deep Drawing. G. Murray. *Sheet Metal Industries*, v. 35, Sept. 1958, p. 657-675.

Theories of the deep drawing process; tests for the assessment of deep drawing properties. (G4b)

524-G. Designing for Production. J. V. Harding. *Sheet Metal Industries*, v. 35, Sept. 1958, p. 676-677, 684.

Ease of manufacture considered as a factor in parts design.
(G3; 17-51)

525-G. (Russian.) **Experiments in Using Disks for Hot Sawing.** V. V. Tatarnikov. *Stal'*, v. 18, Aug. 1958, p. 716-717.

Best results obtained when hardness of cutting teeth was Rockwell C-55 to 60. Annealing lengthens service span by 15%. Use of steel with tensile strength of 70-80 kg. per sq. mm. is recommended.
(G17h, W24m; ST, 2-64)

Powder Metallurgy

129-H. (Russian.) **Study of Certain Laws of Dispersion Hardening of Metal-Ceramic Alloys of Iron-Copper-Carbon.** G. I. Aksenov and V. K. Sorokin. *Poroshkovaya Metallurgiya, Yaroslavl'*, 1956, p. 71-77.

A greater increase in hardness has been observed in Fe-Cu-C metal-ceramic alloys than in copper steel compacts, and more time is required to reach maximum hardness. As the porosity of the specimens increases, the growth in hardness slows down, and the maximum value of hardness increment increases. Increasing Cu content reduces rate of strengthening, a fact most noticeable at high temperature. Additional pressing of the sintered specimens causes a rapid increase in hardness during the first hours of soaking.
(H15, H16; Fe, Cu, C, 6-70)

130-H. (Russian.) **Strength of Metal-Ceramic Hard Alloys of Tungsten**

(*)Articles Available Through Photocopy Service; See Coupon, p. 75.

Carbide and Cobalt. P. S. Kreymer. *Poroshkovaya Metallurgiya, Yaroslavl'*, 1956, p. 115-126.

Optimum combination of wear endurance and strength in WC-Co alloys can be obtained by crumbling the grain with a relatively increased content of Co, or increasing the grain (to 3 to 4 microns) with a relatively reduced content of Co. The energies of the second method are proved. (H-general, Q27a, Q9n; Co, W, C, 6-70)

131-H. Cermet Preparation by Reactions in the Iron-Aluminum-Oxygen System. A. Siede and A. G. Metcalfe. Illinois Institute of Technology. (Wright Air Development Center.) *U. S. Office of Technical Services*, PB 131820, Oct. 1957, 42 p. $1.25.

Investigation to determine if better bonding and finer distribution of aluminum oxide in a metallic matrix could be achieved by method described, and whether the improved structure would have superior properties. Reactive sintering process studied by metallography, thermal analysis and mechanical testing. Excellent bonding between alloy matrix and oxide was found after reactive sintering, but the density was low. (H15; Al, 6-70)

132-H.* (German.) **Influence of Heating Atmosphere on Oxidation of Zinc Powder.** G. Ogiermann and H. Weik. *Metalloberfläche*, v. 12, July 1958, p. 199-201.

Gravimetric experiments on oxidation indicate influence of heating atmosphere and grain size. Heating in air produces greater oxidation than in nitrogen. Oxidation was greatest for fine-grained powders. An unexpectedly large oxidation inhibiting effect results from the alligatoring of the oxide powder on expansion. 6 ref. (H15q, R1h; Zn)

133-H. (Russian.) **Investigation of the Sintering Process of Certain Metal Powders.** V. V. Saklinskiy. *Poroshkovaya Metallurgiya, Yaroslavl'*, 1956, p. 21-51.

During sintering a contact is formed and made closer between particles of the powders as a result of diffusion processes, caused by the temperature mobility of the atoms. Surface diffusion predominates during the initial stage, while volume diffusion predominates in the final stage. Formation of the contact is attributed to forces causing plastic diffusion of the powder particles, and to the action of surface tension that results from liquidation of defects of the crystalline lattice. (H15, N1)

134-H.* (Japanese.) **Alumina Base Cermets. Pt. 2. Effects of Additives on the Adhesion Between Alumina and Iron.** H. Matsumoto, S. Yamauchi and G. Nishiyama. *Nagoya Industrial Experimental Station, Report*, v. 7, July 1958, p. 543-552.

To improve the adhesion between Al_2O_3 and Fe, effects of additives (i.e., MgO, CaO, MnO_2, TiO_2, Al_2O_3, TiO_2, SiO_2 and Cr_2O_3) are studied. Base mixture is 33.5% Al_2O_3 and 66.5% Fe by weight. In the sintering process sweating is observed. Contact angle, bending and compressive strengths at room temperature and shrinkage of the specimens are measured. Contact angle between Al_2O_3 and Fe in A gas flow is 146° C. To make this angle smaller MgO, MgO_2, SiO_2 and TiO_2 additives are useful. If CaO and Si are mixed in the same time, almost no sweating is observed. (H12n; 6-70)

135-H. Study of the Possibility of Reinforcing High-Temperature Alloys by Addition of Refractory Powders. John D. Burney. Metallurgical Research Laboratory. *U. S. Office of Technical Services*, PB 131768, Feb. 1958, 49 p. $1.25.

Attempt to reinforce 80-20 Ni-Cr alloy by addition of such refractory oxides as TiO_2 and Al_2O_3. Several powder metallurgical fabrication techniques were investigated such as pressing and sintering, pressing and sintering followed by various working procedures, internal oxidation and liquid phase sintering. (H-general; SGA-h)

136-H.* **Electrolytic Production of Straight and Alloyed Metal Powders.** I. Ljungberg. *Iron and Steel Institute, Journal*, v. 189, Aug. 1958, p. 303-306.

Electrolytic production of Fe, Ni and ferro-alloy powders used in Sweden over the last ten years. Advantages of using indirect method where brittle product is deposited on cathode and later ground. Suitable electrolyte solution and anode materials. Physical properties of metal powders and properties of sintered alloy steel produced from powders. 13 ref. (H10b; Fe, Ni)

137-H.* **Powder Metallurgy of Refractory Metals.** Alan Blainey. *Metal Progress*, v. 74, Sept. 1958, p. 95-96, 184, 186, 188, 190.

Hydrostatic compaction, extrusion of canned powders and compression within deformable frames are interesting techniques utilized for cladding fuel elements with pure refractory metals and making special shapes for atomic power reactors. (H-general, T11g; Zr, Cb, V, Be, Mg)

138-H.* (German.) **Sintered Shapes; Production and Use.** A. Hohmann. *Giesserei Praxis*, no. 15, Aug. 10, 1958, p. 294-295.

Raw materials for sintered shapes are iron, bronze and brass. Powders made by mechanical reduction, by pulverization or electrolytically. Pressing and sintering. Outstanding characteristics are wear resistance and density. Disadvantages are high production costs, expensive tools, high pressing and heating costs, consumption of "atmospheres" used in heating. Sintered parts are used in sewing machine, office machine and automobile industry. (H-general)

Heat Treatment

305-J. The Use of Steel Forgings at High Strength Levels. C. E. Moeller. Paper from "High Strength Steels for Aircraft", American Society for Metals, 1958, p. 22-29.

Evaluation of austempering as a practical method of heat treatment to the 260 to 280,000-psi strength range, in 4350 steel. Comparison of austempered with quenched and tempered 4350 and 4340 steel. (J26p; ST, SGA-b, 4-51)

306-J. A Practical Application of the Holloman-Jaffe Parameter to the Tempering of Type 410 Stainless Steel. Charles F. Lewis. Paper from "High Strength Steels for Aircraft", American Society for Metals, 1958, p. 77-81.

Holloman-Jaffe tempering parameter has been found useful for type 410 stainless in those ranges where the hardness-temperature curve is moving very rapidly. Published data supplemented by shop observations are treated statistically to arrive at a curve relating final hardness and the parameter T (20 + log t). This in turn is superimposed on curves relating the parameter with time and temperature so as to arrive at a simultaneous solution of the parameteric equations for the hardness required. 5 ref. (J29q, Q29n; SS)

307-J.* (German.) **High-Frequency Induction Gear Hardening Processes.** G. Benkowsky. *Fertigungstechnik*, v. 8, June 1958, p. 241-246.

Processes for multiple-tooth hardening; single-tooth hardening; base hardening; new method of double-frequency multiple-tooth hardening. Steels suited for high-frequency hardening; normalizing; required generator efficiency. Resulting distortion lies within allowed tolerances. (J2g, T7a; ST)

308-J.* **The Pack Carburizing and Annealing of 4¼% Ni-Cr-Mo Case Hardening Steel.** C. Dawes. *Metallurgia*, v. 58, Aug. 1958, p. 69-75.

Influence of various carburizing compounds on the "as-quenched" hardness, microstructure, carbon content and annealing characteristics of the carburized case. Recommendations for a carburizing compound which will prevent the formation of heavy carbide networks and for a standard annealing treatment. Recommended procedures for annealing. (J28g, J23; AY, *Ni, Mo, Cr*)

309-J.* (Japanese.) **Austempering of Spring Steel.** Tsuneo Maenaka. *Metals*, v. 28, July 1958, p. 518-523.

Austempering process should be studied using continuous cooling transformation curve. Heat bath must be kept around 350 to 400° C. It is governed by cooling velocity, secondary bath temperature and cooling solution. High percentage of Mn (0.7 to 1%) is good for slow cooling. Fatigue tests and impulse test show that austempering is much better than ordinary tempering. Other mechanical characteristics are almost the same in both methods. (J26p, N8; ST, SGA-b)

310-J.* (Japanese.) **Electrolytic Heat Treatment.** Hiroshi Susukida and Yoshio Sakumoto. *Metals*, v. 28, July 1958, p. 530-534.

Stationary bath type, rotary bath type, nozzle type. Voltage is about 200 v. Nozzle type is better than bath type when large pieces are tempered. Partial and surface treatments are possible. Depth and degree of treatment can be controlled. Heating causes no oxidation and is rapid. Electrolyte can be used as cooling solution. (J2)

311-J.* (Japanese.) **Tempering and Mechanical Characteristics of High-Temperature Spring Steel.** Hidetsugu Hotta. *Metals*, v. 28, July 1958, p. 545-548.

9% W-Cr-V steel, Si-Mn steel, 13% Cr steel and 18-4-1 standard high speed steel are examined. Tem-

pering is done around 500 to 1000° C. and tested under 50 to 200 kg. stress, 500° C. Hardness, fatigue and impulse tests are done. The 9% W-Cr-V steel is better than the others. The best tempering temperature is 1100° C. followed by holding in a heat bath of 600° C. for 9% W-Cr-V steel.
(J29, Q-general; ST, SGA-b)

312-J.* (Polish.) **Influence of Tempering Upon the Properties of Steel With Bainitic Structure.** Fryderyk Staub and Jerzy Tymowski. *Hutnik*, v. 25, May 1958, p. 133-142.

Changes of structure and properties of steel hardened isothermally and tempered. Changes taking place in the bainitic core. Results of mechanical investigations and metallographic observations with electron microscope for four structural alloy steels. Conclusions regarding behavior of steel with bainitic structure upon tempering in comparison with hardened martensitic steel. 13 ref.
(J29, Q-general, N8m; ST)

313-J. Heat Treatment and Cleaning in Wire Production. Ernest Hague. *Metallurgia*, v. 58, Aug. 1958, p. 80-83.

Equipment and layout at Kingfield plant of Darwins Bright Steels Ltd. (J-general, L-general, 1-52, 4-61, 18-67)

314-J. (Russian.) **Low-Temperature Cyaniding of Casting Dies.** S. B. Svishchova and M. S. Barilo. *Vestnik Mashinostroeniya*, v. 38, Aug. 1958, p. 41-43.

Cyaniding surface of press form to 0.08-0.15 mm. thickness eliminates cracks and chemical interaction between dies and casting. 4 ref.
(J28j, W19n)

315-J.* Salt Bath Heat Treatment Versus Quench and Temper Standard and Pearlitic Malleable. P. W. Green. *Modern Castings*, v. 34, Oct. 1958, p. 41-46.

Manufacturing methods used in production of standard and pearlitic grades of malleable iron; physical property comparison between oil-quench and temper and isothermal salt transformation; comparison of microstructures, mechanical properties and hardness values obtained from the two heat treating techniques. (J26, J2j; CI-s)

316-J.* (French.) **Technical Prerequisites for Heat Treatment.** Jean Gonin and Gerard de Smet. *Machine Moderne*, no. 592, July 1958, p. 11-16.

Good furnaces, precision pyrometers and adequate quenching equipment are indispensable. Simple device for observation of recalescence effect. Rules for heating parts; no heating (except special steels), oxidation and decarburizing protection, no sudden temperature changes, necked-down sections protected with iron wire or asbestos braid. Distortion avoided by fixtures applied to part immediately after heating. Parts with tendency to distortion should not be heated on uneven furnace bottoms. (J-general, 1-52; ST)

317-J.* Generation and Use of Prepared Atmospheres in the Annealing of Low-Carbon Steel Strip. George J. Campbell. *Industrial Heating*, v. 25, Sept. 1958, p. 1749, 1750, 1752, 1754, 1758, 1760, 1762, 1764.

Practical use of prepared atmosphere in the batch annealing of tin plate and cold rolled sheet coils of low-carbon steel. The steps necessary to produce an acceptable gas and the effect on strip surface when gases vary beyond certain fixed chemical composition.
(J2k, J23; CN-g, 4-53)

318-J.* Mass Spheroidized Annealing of Alloy Seamless Tubing in Roller Hearth Furnace. Walter J. Assel. *Industrial Heating*, v. 25, Sept. 1958, p. 1769, 1770, 1772, 1774.

Hardening and annealing of alloy seamless tubing to spheroidized structure with minimum decarburization on both surfaces in a controlled atmosphere roller-hearth furnace. (J23r, J2k, W27g; AY, 4-60)

319-J.* Case History of Induction Hardening Large Drive Gear. Victor H. Pagano and Charles J. Kropf. *Metal Progress*, v. 74, Sept. 1958, p. 86-90.

Changing from carburizing to induction hardening permitted the use of less costly steels and saved 5 lb. of Ni and 0.3 lb. of Mo per gear. Heat treating time was decreased, material handling was simplified and it is claimed that the change resulted in a tenfold increase without sacrificing quality.
(J2g, T7a; ST)

320-J. Study of the Factors Influencing the Properties of Heat Treatable Titanium Sheet Alloys. R. S. Richards, D. L. Day and H. D. Kessler. Titanium Metals Corp. of America. *U. S. Office of Technical Services*, PB 131769, Mar. 1958, 279 p. $4.

Properties of two Ti sheet alloys, Ti-4Al-3Mo-1V and Ti-2Al-6Mo-2V investigated in the annealed, solution treated and aged conditions.
(J27; Ti-b, 4-53)

321-J. Softening High-Alloy Carburized Steels. Yu. G. Vyshkovskii. *Metallovedenie i Obrabotka Metallov*, Aug. 1958, p. 43-46. (Henry Brutcher, Altadena, Calif., Translation no. 4321.)

To prevent decarburization during heating, test pieces were coated with Cr (20 mk. thick). The microstructure of carburized steel has a notable effect on surace hardness after softening treatment. Increased hardness is conditioned by presence in carburized surface of increased amounts of residual austenite and free carbides. To obtain satisfactory results in the softening treatment and to shorten length of process, it is necessary to avoid supersaturation of cementite layers with carbon by using a low-intensity carburization procedure.
(J28g, Q29; ST)

322-J.* (Polish.) **Influence of Ultrasonics Upon the Carburization of Steel.** Waclaw Rozanski. *Archiwum Hutnictwa*, v. 3, no. 2, 1958, p. 125-146.

Specimens of low-carbon steel containing 0.12% C were treated in a carburizing medium of 70% charcoal, 20% barium carbonate and 10% sodium carbonate at temperatures from 850 to 1000° C. for times from 30 to 120 min. Ultrasonic generator was utilized to develop standing ultrasonic waves in specimens during carburizing. Effect of ultrasonics depended on values of tensions evoked. At small intensities, carbon diffusion and thickness of cemented layer increased. At higher values of ultrasonic intensities, graphitization occurred during cementation. Some specimens ruptured in places of greatest tension and graphitization. 15 ref.
(J28g, 1-74; CN-g)

323-J.* The Application of Rate Process Theory to the Heat Treatment of Titanium Alloys. N. M. Erkun. *American Society for Metals, Transactions*, v. 51, Preprint no. 90, 1958, 16 p.

Time-temperature relationship applied to the heat treatment of 1-in. round bars of C-120AV (Ti-6Al-4V) and C-135AMo (Ti-7Al-4Mo) alloys. Using the rate process equation and considering only overaged portion of the aging curves, the constant C in the aging parameter T (C + log t) was found to be 15 for C-120AV and 20 for C-135AMo. By making use of the aging parameters, tensile properties, hardness and impact values of both alloys were plotted to show the relationship between mechanical properties and aging times and temperature at a constant solution treatment. 12 ref.
(J27d, Q-general; Ti-b)

324-J.* Multiplying Factors for the Calculation of Hardenability of Hypereutectoid Steels Hardened From 1700° F. C. F. Jatczak and D. J. Girardi. *American Society for Metals, Transactions*, v. 51, Preprint no. 99, 1958, 15 p.

Hardenability effects of Mn, Si, Cr, Ni, and Mo, singly and in combination, were studied in 1% C steels by the end quench test at a quenching temperature of 1700° F. and from normalized and spheroidized prior structures. Two different sets of hardenability factors were derived. One set, based on a normalized prior structure, can be used to predict the case hardenability of carburizing steel grades at carbon levels of 0.75 to 1.25%, and the other, based on a spheroidized prior structure, is for the hardenability prediction of homogeneous hypereutectoid analyses, such as toolsteels. Hardenability factors were obtained for each element to a level of 1.50% or higher with the exception of Mo whose effect was determined up to 1%. 11 ref.
(J5, 2-60; AY)

325-J.* Mechanized Austempering of Steel Harrow Disks. *Metal Progress*, v. 74, Sept. 1958, p. 78-80.

Parts are heated to 1575° F. in a neutral salt bath for 1.6 min., then austempered at 750° F. in a nitrate salt for 6 min. The bainitic structure obtained prevents directional cracking. (J26p, 18-74; ST)

326-J. (Russian.) **Suitable Conditions for Induction Hardening of Equipment Parts.** A. M. Shirokov and A. N. Zannes. *Stal'*, v. 18, Aug. 1958, p. 730-736.

Installation for induction hardening with power of 100 kvt. and frequency of 2500 Hertz hardens working surface to a depth of 2-4 mm. Durability is increased on the average 2-3 times. (J2g; ST)

K Assembling and Joining

546-K.* Gas Shielded Self-Adjusting Arc Welding as Applied to Steels. H. Levinsohn. *New Zealand Engineering*, v. 13, July 15, 1958, p. 273-278.

Control, efficiency of shielding

(*)Articles Available Through Photocopy Service; See Coupon, p. 75.

with argon, helium and CO_2, with and without O_2 added, on stainless steels. (To be continued.)
(K1d; SS)

547-K. Joining and Inspection of Joints. J. C. Herr. Paper from "Sheet Materials for High Temperature Service", American Society for Metals, 1958, p. 69-74.

Problems of brazing, welding and bonding of stainless steel, Ti, Mg and Al alloys. Inspection techniques include X-ray, fluoroscopy and ultrasonics.
(K-general, S13; SS, Ti, Mg, Al)

548-K.* (German.) **Repair Welding Cast Iron Ingot Molds.** Karl Petschauer. *Giessereitechnik*, v. 4, June 1958, p. 125-128.

Cast iron ingot molds used in steel mills frequently crack due to the extreme stress developed. In preparation for repair the erosions are cleaned to the bare metal and the cracks are widened. This may be done with oxy-acetylene process or arc welding using carbon electrodes. Test results show Brinell hardness 110-205 and structural strength 14.2-24.5 kg. per sq. mm.
(K1h, K2h, W19c; CI, 18-72)

549-K.* (French.) **Welding Chromium-Molybdenum Steel.** Paul De Marneffe. *Revue de la Soudure*, v. 14, no. 2, 1958, p. 67-73.

Welding methods for Cr-Mo steels used in the construction of oil refineries. Homogeneous welding usually is not possible because the complicated forms and large dimensions preclude subsequent heat treatment. Heterogeneous welding with austenitic electrodes appreciably decreases stress due to contraction and does not change the composition of the steels. Austenitic electrodes depositing a steel with mixed microstructure containing some ferrite show less cracks. Completely austenitic steels perform better in spite of the presence of some microcracks, which may even be helpful in reducing stresses.
(K1; AY, SS, *Cr, Mo*)

550-K.* (French.) **Problem of Cracking in Austenitic Stainless Steel Welding.** Jean Sebille. *Revue de la Soudure*, v. 14, no. 2, 1958, p. 91-118.

Types and origin of cracks; structure; intergranular constituents; dendrictic segregation problem; chemical components, including Cb, S, O and contamination of chemical origin; influence of sigma phase; influence of stress; grain size resulting from different welding methods. Ferrite introduced into austenitic stainless steel decreases chances of cracking. 81 ref. (K9n, 9-72; SS-e)

551-K.* Magnetic-Force Welding. Ford R. Park. *Product Engineering*, v. 29, Sept. 15, 1958, p. 82-85.

Adaptation of projection welding techniques, applying forging pressure at time when weld zone is most fluid permits strong weld without damage to vinyl coating.
(K3q)

552-K.* (Dutch.) **Manufacture of High-Pressure Containers.** J. H. A. Wennink. *Lastechniek*, v. 24, June 1958, p. 101-103.

Pressure vessels manufactured either from low-alloy, creep proof, heat resistant steel with 1% Cr and 0.5% Mo corresponding to ASTM 301-Gr.B or from "clad steel" (i.e., steel with 0.5% Mo-type ASTM 204-Gr. A), clad with 4 mm. 18-8 stainless steel (Type 347). Both materials are preheated to 200° C. before autogenous cutting and welding. Plates are cut, tested with ultrasonics and formed into semicylindrical bodies either by press or by hot rolling. When welded, the filler metal must have the same composition as the base metal. Weld testing methods.
(K9, T26q; SS)

553-K. Arc Spotwelding Stiffens Louver Panels. Richard Molthop. *American Machinist*, v. 102, Sept. 8, 1958, p. 90-91.

Manual arc welder joins angle-iron stiffeners to sheet stock by spot welding through a drilled templet. Eliminates sheet distortion and reduces costs without loss in quality. (K1d; CN-g)

554-K. Fastening Devices. John J. Dwyer, Jr. *American Machinist*, v. 102, Sept. 8, 1958, p. 97-112.

Properties, applications of rivets, screws, bolts, studs, locknuts, inserts, pins, washers, retaining rings, quick release fasteners. (K13)

555-K. High Quality Fusion Welding of Aluminum. Pt. 2. Thomas B. Correy. *Light Metal Age*, v. 16, Aug. 1958, p. 12-14, 16, 22.
(K1, W29a; Al-b)

556-K. Contribution of Brazing in Light Engineering. E. V. Beatson. *Machinery (London)*, v. 93, Aug. 27, 1958, p. 473-481.

Brazing of heat resistant alloys, stainless steel; high-frequency and induction brazing; process selection, design and development of methods.
(K8; SS)

557K. Pressure Welding. *Metal Industry*, v. 93, Aug. 22, 1958, p. 152-154.
(K5)

558-K. Soldering Aluminum — a Simple Fluxless Technique. G. M. Bouton and P. R. White. *Product Engineering (Design Digest)*, v. 29, Sept. 1958, p. G10-G11.

High-strength joints formed by heating pieces with a torch, applying a Zn-base solder stick. Solder flows under oxide film, wetting Al, giving secure bond. (K7c; Al-b)

559-K. Ultrasonic Welding Comes of Age. J. Byron Jones and W. C. Potthoff. *Tool Engineer*, v. 41, Sept. 1958, p. 90-94.
(K6r)

560-K. Brazing Honeycomb Sandwich. Frank J. Filippi. *Tool Engineer*, v. 41, Sept. 1958, p. 98-101.

Brazing done in inert gas-filled retort, using pneumatic bay for pressure, temperatures up to 2200° F. Uniform heating obtained by using dummy mass to create thermal balance. (K8j; 7-59)

561-K.* (Dutch.) **Welding of Stainless Steel.** B. Mulder. *Lastechniek*, v. 24, June 1958, p. 95-100.

Use of tack welds in preliminary spacing of plates; shrinking phenomenon in tack welds. Magnetic field effect on the arc. Electrodes are of stainless steel. (K1; SS)

562-K. (Dutch.) **Stud Welding in Practice.** J. A. N. Clevers. *Lastechniek*, v. 24, June 1958, p. 103-106.

Stud welding can offer various advantages; time saving, no weakening of the material by drilling holes, lighter construction and no leaks. Has been used for several decades in America in ship-building, construction of buses, boiler-making, anchoring of fire resistant furnace walls, bridge-building and suspension of pipelines. (K1f)

563-K. (Japanese.) **Ultrasonic Welding.** Naoyuki Watanabe. *Metals*, v. 28, July 1958, p. 512-515.

High-tension ultrasonic waves can weld either homogeneous or heterogeneous pairs of metals. Static load range is 2 to 360 kg., frequency is 4 to 40 kc., power is 100 w. to 2 kw., and a pulse lasts 0.5 to 1.5 sec. Method is most suitable for welding metallic foils but is also applicable for thin plates. Metals are welded without being melted.
(K6r)

564-K.* Welding the Refractory Metals. L. F. Yntema. *Metal Progress*, v. 74, Sept. 1958, p. 105-108.

Tantalum, columbium, molybdenum and tungsten are used on many devices operating at high temperatures because of their high melting points and high-temperature strength. Because of their reactivity with air and their affinity to low-melting metals, they require careful control of welding variables.
(K-general; EGA-d, Ta, Cb, Mo, W)

565-K.* Effect of Surface Treatment on the Adhesive Bonding Properties of Magnesium. H. W. Eickner. *University of Wisconsin, Forest Products Laboratory, U. S. Dept. of Agriculture*, no. 1865, June 1958, 30 p.

Several types of surface treatments for AZ31-H24 Mg, including deoxidizing, chemical sealing and anodizing methods, were investigated as pretreatments for bonding with commercial metal-bonding adhesives. In addition to original tests of bond quality, tests were also made after the specimens were aged at elevated temperature, high humidity and salt-water spray conditions. 17 ref.
(K12, L-general; Mg-b)

566-K.* Brazing Alloys for Guided Missiles. A. T. Cape. *Metal Progress*, v. 74, Sept. 1958, p. 99-104.

Many types of brazing alloys are available and selection of the right one for the job depends on such factors as kind of materials to be joined, service to which it will be subjected and methods of brazing to be used. Modifications of standard brazing materials can be used to give added joint strength and other special properties.
(K8, T24e; SGA-f)

567-K.* Chlorine Improves Aluminum Weld. (Digest of "Chlorine Additions for High-Quality MIG Welding of Aluminum Alloys". M. B. Kasen and A. R. Pfluger. Western Welding, Brazing and Heat Treating Conference, Stanford Research Institute, Menlo Park, Calif., Mar. 1958.) *Metal Progress*, v. 74, Sept. 1958, p. 145-146, 148, 150, 152.

Addition of minute quantities of Cl to the arc area during flat-position MIG welding of Al-Mg alloys will effectively counteract hydrogen, propane, water vapor and oxygen when each contaminant is present in the arc area in sufficient quantity to seriously affect quality of the welds. Chlorine additions are also effective in counteracting the deleterious effects of contaminants on the filler wire surface. (K1d; Al-b)

568-K.* Fabrication of Hollow Steel Propeller Blades. Frank J. Altmann. *Welding and Metal Fabrication*, v. 26, Aug. 1958, p. 272-276.

Contour rolling, precision forging, flash and fusion welding in the production of hollow propeller blades from AMS 6434 steel.
(K-general, F22, F23, T24; AY)

569-K.* **Gas-Electric Welding With Constrained Moulded Joints.** D. A. Dudko and F. M. Vinogradskii. *Welding and Metal Fabrication,* v. 26, Aug. 1958, p. 289-290.

Process details and advantages in carbon dioxide-shielded, metal-arc welding with constraining molds for semi-automatic and automatic welding of steel 0.31 to 1.5 in. thick in any position. (K1d; ST)

570-K.* (English.) **Lining a Steel Pressure Vessel With Titanium.** F. F. Ates. *Lastechniek,* v. 24, July 1958, p. 131-136.

Incorporation of fixed Ti lining, 0.8 mm. thick, into a steel pressure vessel, about 80 cm. in diameter and 4 m. long for use in petrochemical industry at working temperature of 140° C. and pressure of 8 atm. Welding equipment, conditions and procedure in spot welding and argon-shielded arc welding of Ti lining. Causes of weld cracking and failure. (K1d, K3n, T26q; ST, Ti)

571-K.* (English.) **Use and Application of Clad Steel. Metallic Liners and Overlay Deposits in the Manufacturing of Vessels for the Chemical Industry.** L. Capel and C. Nederveen. *Lastechniek,* v. 24, July 1958, p. 136-149.

Chemical composition and mechanical properties of backing plates and stainless steel cladding material. Joint design and electrode selection related to problems in welding clad steel. Effects of weld dilution by base material and mild steel electrodes on weld cracking and defects. Heat treatment and application of clad steel; application and welding of metallic liners. Deposit welding and uses for corrosion resistant stainless steel deposits. (K1, T26q; SS, 8-66)

572-K.* (Dutch.) **Welding of Aluminum in General and for Shipbuilding in Particular.** *Lastechniek,* v. 24, Aug. 1958, p. 161-170.

General direction for electric welding. Distance regulator, recommendation of a high-frequency generator to simplify the ignition and stabilization of the arc. Tools and accessories needed. Importance of careful selection and preliminary processing of the plate. Adjustment of the edges of the plates must be absolutely correct and the advance aperture must have the same width throughout; fastening plates together for butt welding; preliminary cleaning with revolving steel brush, dressing with flat chisel, removal of slag pockets, grinding; horizontal welding of butt seams; angle welding. (K1, 1-52; Al)

573-K.* (German.) **Further Development in Cold Pressure Welding.** Wilhelm Hofmann and Hans-Jurgen Schuller. *Zeitschrift für Metallkunde,* v. 49, June 1958, p. 302-311.

Silver and gold specimens were butt welded in high vacuum and results compared to welds in inert atmosphere. To reduce the pressure required for cold welding, various shapes of specimens were tried out; and the deformation process as well as the influence of time was studied. Armco iron was butt welded with Al and Cu. A joint approaching the tensile strength of Al was obtained, while with Cu cold hardening prevented consistent results. 33 ref. (K5, 1-67; Ag, Au, Fe, Al, Cu)

574-K.* (Russian.) **Effect of Arsenic on Weldability of Low-Carbon Steels.** A. G. Kalashnikov. *Stal',* v. 18, Aug. 1958, p. 736-739.

Method of forge welding without fluxes of Ct. 3 steel containing up to 0.25% As with bar thickness up to 20 mm. Weldability of thin bars of killed steel is higher than that of rimming steel. As bars increase above 20 mm. thickness, welding becomes more difficult; and with further increase of As content above 29%, the quality of the welds decrease. 7 ref. (K9s, 2-60; CN-g, *As*)

575-K.* (Russian.) **Structure and Mechanical Properties of Alloy Welds in Titanium.** S. M. Gurevich. *Metallovedenie i Obrabotka Metallov,* Aug. 1958, p. 18-21. (Henry Brutcher, Altadena, Calif., Translation no. 4315.)

Effect of alloy elements on structure of high-strength Ti welds. By alloying the welds to 4-5%, without changing its single-phase structure, the plasticity of the weld is preserved to a large extent. To stabilize the beta phase, the maximum limit of weld alloying should not exceed 2-3%. Alloy metal welds with an original needle-like beta phase microstructure have best plasticity and ductility after welding. 9 ref. (K9, M27, Q-general; Ti)

576-K.* (Russian.) **Localized Heat Treatment of Welds Made by Electroslag Process.** V. N. Novikov, I. E. Tutov and A. I. Kondrashev. *Metallovedenie i Obrabotka Metallov,* Aug. 1958, p. 38-43. (Henry Brutcher, Altadena, Calif., Translation no. 4320.)

Welding of plate steel (100 ton) of type 22K. The large crystal structure of welds produced by electroslag process is rectified by normalizing, thereby increasing plasticity of steel. After normalizing the mechanical properties of the welds and adjacent areas are in every respect similar to those of basic metal plate, regardless of methods used to heat the weld. The most effective heating method for normalizing metal in area of weld is induction heating at industrial frequencies. For plates with 0.22% C, localized electrothermal treatment is most effective. (K6, J24; ST, 4-53)

577-K.* (Russian.) **Automatic Arc Welding of Aluminum Alloy Sheets.** G. D. Nikiforov. *Svarochnoe Proizvodstvo, Aug. 1958,* p. 7-10.

New Al alloy of excellent weldability contains 6.5% Mg, 0.7% Mn and 0.3% Ti. Combination of Mg with Al results in supersaturated alloy which does not decompose during annealing. The combination of Mn with iron, $Al_6(MnFe)$, increases corrosion resistance of alloy. Welding by fuzing electrodes under blanket of flux results in a weld as strong as original metal. (K1, 2-60; Al-b, 4-53)

578-K.* (Russian.) **Study of Tendency of Weld Metal to Form Hot Cracks.** M. Kh. Shorshorov and V. S. Sedykh. *Svarochnoe Proizvodstvo,* Aug. 1958, p. 10-14.

Investigation of low-carbon and austenitic steels, welded with different types of electrodes. Hot cracks formed during crystallization of metal seam as result of tensions arising during cooling of weld. Liquid layers are present during formation of dendrites. At a given interval during crystallization the metal has extremely low plasticity. It is during these temperature intervals that cracks form at points where the intermetallic bonds are weakest. 7 ref. (K1, K9, 9-72; CN-g, SS)

579-K.* (Slovakian.) **Copper-Phosphorus Brazing Alloys.** Pavel Slysko. *Zvaranie,* v. 7, Aug. 1958, p. 245-248.

Copper and low-carbon steel were brazed with the mixture Cu-P8 (=CSN 423370). To braze tombac, a high-phosphor mixture (5.72% Ag, 86.8% Cu, 7.15% P and 56.5% Cu, 2.0% Si, 5.90% P, 35.5% Zn) and a low-phosphor mixture (56.5% Cu, 2.05% Sn, 0.98% Si, 3.96% P, 36.5% Zn) were used. For steels, the above mixtures are not recommended because of the formation of brittle phosphides in the transition zone between the basic metal and the braze alloy. (K8; Cu, CN-g, SGA-f)

580-K.* (Slovakian.) **Repair Welding of Slag Pits in the Surface of Railway Wheels.** Ladislav Muncner. *Zvaranie,* v. 7, Aug. 1958, p. 251-252.

Slag pits in the larger flat surface of 20 x 30 x 300-mm. tires of unalloyed carbon steel with 0.43% and 0.60% C repaired by cutting out pit to clean material, preheating to 320-370° C., filling pit using a 5-mm. diameter electrode E44.33 or E44.83, reheating to 320° C. for ¼ to 1 hr. in air, tempering at 540-560° C. for 5 hr. in air, grinding smooth. Repaired surface tested for defects. (K1, 18-72, T23; ST)

581-K.* **The Relationship Between Weld Cracking and Alloy Constitution in Some Binary and Ternary Magnesium Alloys.** C. L. Kobrin and R. A. Dodd. *American Society for Metals, Transactions,* v. 51, Preprint no. 101, 1958, 7 p.

The susceptibility to weld cracking of alloys corresponding to various Mg-rich binary systems is investigated using a restrained weld test. The variation in results with the different alloy systems can be reasonably well interpreted in terms of the respective solidification ranges, and only the Mg-rich Mg-Zn alloys are sensibly prone to cracking. Cracking versus composition contours are given for the industrially important Mg-Zn-Al and Mg-Zn-rare earth systems. 14 ref. (K9n, M24b, M24c; Mg, 9-72)

582-K.* **Resistance Welding Procedures and Design.** Lester F. Spencer. *Welding Engineer,* v. 43, Oct. 1958, p. 44-47.

Resistance welding equipment and controls. Single-phase a-c. machines are the "work horses". The dry-disk rectifier system, used for spot, projection and seam welding, is also used to convert three-phase power to single-phase d-c. In welding high-conductivity alloys and materials with narrow plastic ranges, the equipment must have low inertia in the electrode holder and a movable head. Both pre- and postheat controls are mandatory in resistance welding hardenable carbon and alloy steels. (K3, 1-52, W29c)

583-K.* **Ultrasonics: a "Sound" Welding Technique.** *Welding Engineer,* v. 43, Oct. 1958, p. 52, 53.

Degreasing, welding, weld inspection and shop decontamination are some of the uses of ultrasonic sound waves. (K6r)

584-K.* **Submerged-Arc Welding of Uranium.** Gale S. Hanks, J. M. Taub and E. L. Brundige. *Welding Journal,* v. 37, Sept. 1958, p. 890-896.

(*)Articles Available Through Photocopy Service; See Coupon, p. 75.

Submerged-arc process offers a welding technique where the flux forms a fluid protective blanket above the liquid filler metal. Both fused flux and filler metal cool and solidify under the unfused flux. Properties of weld metal made by submerged-arc welding using the developed flux showed tensile strengths nearly 65% greater and yield strengths approximately 95% greater than those of as-cast metal. (K1e; U)

585-K.* Comparisons Between Welds in Iodide and Sponge-Base Titanium Alloys. W. J. Lewis, M. L. Kohn and G. E. Faulkner. *Welding Journal,* v. 37, Sept. 1958, p. 385s-390s.

Comparisons between the tensile strength, weld-joint bend ductility and weld-metal notch toughness of the iodide and sponge-base alloys, indicated that increased interstitial and substitutional alloy content strengthened the alloys, but weld-joint bend ductility and weld-metal notch toughness were adversely affected. Starting with iodide-base alloys which contain 1.5% beta stabilizers, the tensile and yield strengths were doubled (an increase of 40,000-60 000 psi.) by combining the strengthening effects of the higher interstitial content of the sponge-base alloys, a 1.5% beta-stabilizing addition and a 3% Al addition. (K9r, K9s; Ti-b)

586-K.* Experimental Results of the Slag-Metal Interaction in Manual Arc Welding. Minoru Okada and Harumasa Nakamura. *Osaka University, Technology Reports,* v. 7, Oct. 1957, p. 425-437.

Study of the reaction (FeO) + [Mn] $\rightleftarrows$ [Fe] + (MnO) in manual arc welding of steel. The following reactions are observed: (1) reaction of filler metal and flux passing through air; (2) reaction in the molten pool. (K9n, K1)

587-K.* (Russian.) **Welding Cast Austenitic Steel.** A. E. Runov, F. I. Pashukanis and K. V. Lyubavskii. *Svarochnoe Proizvodstvo,* Aug. 1958, p. 1-7.

Presence of a certain quantity of the ferrite phase in the original cast austenitic Cr-Ni steel eliminates cracking which has led to development of new alloy—IX20N12T-L—that can withstand prolonged working at 600°. Alloy has ferrite content of 1.5%, and has high plasticity after heat treatment as well as after aging. Variation in cooling rate has no effect on ferrite phase or steel structure. 7 ref. (K9, 2-60; SS, 9-72)

588-K.* (Russian.) **Pressure Welding of Heterogeneous Metals Under Vacuum.** N. F. Kazakov. *Svarochnoe Proizvodstvo,* Aug. 1958, p. 23-24.

Success in welding metal-ceramics depends on Co content as well as on grain size. The smaller the grain structure the stronger the weld. Pressure and surface cleanness also have big influence. Increase in pressure at low temperatures shows little effect on weld strength, but pressure increase at high temperatures has a marked effect. The rougher the surface, the weaker the welds. Welding in vacuum, and without oxidation, eliminates brittle cracks and other defects. (K5, 1-73; 6-70)

589-K. Boost Powder Metal Part Size. R. H. Weichsel and E. T. Johnson. *Iron Age,* v. 182, Oct. 2, 1958, p. 80-81.

Large, complex powder metal bearings, other shapes possible through new Ag soldering technique which creates thin joints with strength equal to parent metal. (K7f; Ag, 6-72)

590-K. Dip Brazing of Aluminum Pays With Accurate Assemblies. E. G. Slotta. *Iron Age,* v. 182, Sept. 25, 1958, p. 92-93. (K8n; Al-b)

591-K. Magnetic-Flux Gas Shielded Arc Welding. J. E. Dato. *Iron and Steel Engineer,* v. 35, Sept. 1958, p. 160-165.

New process, using flux conveyed to wire electrode by CO_2 shielding gas and magnetically coating the wire, produces rapid, sound welds. (K1d)

592-K. Riveting Is No Small Job. Bartlett West. *Modern Machine Shop,* v. 31, Oct. 1958, p. 117-121.

Semi-automatic riveter is used in scatter-pattern riveting of large fuselage panels for DC-8 jet-propelled airliners. (K13n, W1h, T24a; 18-74)

593-K. Fabricating Plastic-Clad Sheet Metals. *Welding and Metal Fabrication,* v. 26, Aug. 1958, p. 294-297.

Techniques utilized in drawing, spot welding, projection welding, steel or Al sheet laminated with polyvinyl chloride film. (K3, G4; Al, ST, 7-59)

594-K. Control of Melting Rate and Metal Transfer in Gas-Shielded Metal-Arc Welding. Pt. 2. Control of Metal Transfer. W. A. Lesnewich. *Welding Journal,* v. 23, Sept. 1958, p. 418s-425s.

Axial-spray transfer is preferred to globular transfer and to rotating-spray transfer to assure maximum arc stability and minimum spatter. (K1d)

595-K. Cooperative Investigation of a New Welding Electrode for Stainless Steel. R. D. Wylie. *Welding Journal,* v. 23, Sept. 1958, p. 426s-432s.

Evaluation of a new welding procedure for use in high-temperature steam piping. Tensile properties, impact-test results including the effect of aging, corrosion and oxidation resistance, high-temperature creep, relaxation and stress-rupture. 16 ref. (K1, W29L, Q-general; SS, 4-60)

596-K. (Russian.) **New Materials and Equipment for Gas Welding.** *Svarochnoe Proizvodstvo,* Aug. 1958, p. 37-41. (K2, 1-52)

597-K. (Russian.) **Vibration Strength of NL2 Steel Butt Welds.** V. N. Savel'ev, D. I. Navrotskii, V. A. Makurin and V. Yu. Shishkin. *Svarochnoe Proizvodstvo,* Aug. 1958, p. 14-18.

Uniform strength of low-alloy steel welds can be obtained by vibrational as well as static stress. Method proposed for eliminating localized weaknesses so as to achieve uniform butt weld strength. (K1, Q27; ST, 7-51)

598-K. (Pamphlet.) **Kaiser Aluminum Weldor's Training Manual—Inert Gas Process.** 129 p. 1958. Kaiser Aluminum and Chemical Sales, Inc., 919 N. Michigan Ave., Chicago 11, Ill. $1.

First section presents essential factors about both tungsten-inert-gas and metal-inert-gas welding techniques. Second and third sections offer step-by-step exercises. (K1d, A6k; Al)

L Cleaning Coating and Finishing

701-L.* Organic Finishing of Aluminum and Its Alloys. Lester F. Spencer. *Metal Finishing,* v. 56, Aug. 1958, p. 58-61, 69.

Procedures used in painting Al differ from those used for steel; the largest variable is the manner in which the surfaces are prepared for painting. Various types of finishes. 7 ref. (L26; Al)

702-L. Ceramic Coatings for Protection of High-Temperature Materials. Nathaniel Cannistraro. Paper from "Sheet Materials for High Temperature Service", American Society for Metals, 1958, p. 25-36.

Variety of coatings available can be grouped into three basic types: Coatings for low-carbon or low-alloy steels; stainless steels of either AISI 300 or 400 series; or super high-temperature alloys. Applications include coatings on engine parts such as combustion chambers, inlet guide vanes, turbine blades, afterburners and tail cones. (L27; CN, AY, SS, SGA-h)

703-L.* (French.) **Diffusion of Aluminum and Beryllium in Nickel and Nickel Alloys and the Protection Provided Against the Effect of Hot Gases.** H. Buckle and J. Moisan. *Recherche Aeronautique,* no. 64, May-June, 1958, p. 27-33.

Solubility of Al and Be in Ni is too low to provide good corrosion resistance to solid solutions obtained by conventional diffusion processes. With new diffusion technique, Al or Be-rich coatings composed of definite compounds (AlNi, $AlNi_3$, BeNi, Be_2Ni) can be applied to Ni and Ni alloys. Coatings obtained have Vickers hardness of 500 to 1500 kg. per sq. mm. and provide perfect protection against oxidation in open air up to about 1100° C. Al_xNi_y films are only slightly brittle, but in combustion gases they deteriorate at temperatures over 800° C. as a result of chemical reaction. Be_xNi_y coatings are chemically stable in combustion gases up to about 850° C., but have low ductility. 8 ref. (L15; Ni, *Al, Be,* SGA-h)

704-L.* Electropolishing. What, How and Why. John F. Jumer. *Metal Finishing,* v. 56, Aug. 1958, p. 44-47.

Surface conditions, regardless of metal or alloy, determine to a large extent the degree of successful electropolishing. Greatest contributing factors towards unsatisfactory results are: large grain size, nonuniform structure, nonmetallic inclusions, directional roll marks, salt or scale contaminations, overpickling and insufficient or excessive cold reduction. Fine-grained deposits are more important than bright electroplated items when electropolishing for true reflected finishes. (To be continued.) (L13p)

705-L.* An Introduction to Vacuum Metalizing. M. A. Self and John Scharnberg. *Metal Finishing,* v. 56, Aug. 1958, p. 54-57.

Parts to be metallized with Al are usually given a resin-base coat. Al staples are hung on W wire filaments near the center of a vacuum

chamber. The temperature of the filaments is raised to 1200° F., which causes the Al to melt and flow over the filament surface. An increase in temperature to 1800° F. evaporates the Al which then radiates from its source, coating all areas in a direct line with a thin film. Comparison with Cr plating. (L23; Al)

706-L.* (Japanese.) **Visual Inspection of Paint Film and Choice of Paint.** Yuji Tsuji. *Metal Finishing Society of Japan, Journal,* v. 9, May 1958, p. 21-26.

Odor, dryness, runs, sags and grain are inspected during painting. After painting, color, odor, brush mark, bubbling, pinholing and wrinkling are inspected. 48 ref. (L26n, S13d)

707-L. Preparation of Protective Coatings by Electrophoretic Methods. A. C. Werner and R. J. Abelson. Vitro Corp. of America. (Wright Air Development Center.) *U. S. Office of Technical Services,* PB 131726, Feb. 1958, 26 p. $.75.

Process for depositing alloys to serve as intergranular diffusion barriers between the Mo base and the Ni-Cr layer. Multi-layer coatings of 80-20 Ni-Cr and Ni-bonded columbium and titanium carbide provided good oxidation and erosion resistance. The ballistic impact resistance requirement was fulfilled by inclusion of a 50% dense, 80-20 Ni-Cr.
(L29p; Mo, *Ni, Cr,* SGA-h)

708-L.* (German.) **Anodic Behavior of Different Type Nickels in Plating Baths. Pt. 2.** E. Raub and A. Disam. *Metalloberfläche,* v. 12, July 1958, p. 193-197.

Examination of the electrolytic polarization of different Ni anodes by anodic dissolution. Rolled Ni anodes show high polarization; electrodeposited fine-grained Ni anodes show low polarization. When similar anodes are used, pure chloride baths give the lowest polarization, while bright baths show the highest. Measuring the anodic electrolytic efficiency showed slight differences, but in all cases was close to 100%. Sludge formation was smallest for rolled Ni anodes.
(L17b; Ni)

709-L.* Some Observations on Aluminizing of Steel. A. N. Kapoor, A. B. Chatterjea and B. R. Nijhawan. *Indian Institute of Metals, Transactions,* v. 9, 1955-1956, p. 167-181.

Mechanical deformability of hot-dip aluminized steel depends on the characteristics of the alloy layer. Growth of the alloy layer at a particular temperature was roughly parabolic, being governed by an empirical relationship which is given. Presence of other elements in the bath appeared likely to affect diffusion so the influence of Fe, Si, Cu, Ti, Zn and misch metal either singly or in conjunction were investigated. Presence of 0.25% misch metal with 0.4% Ti and 2% Si gave preferred coating. 11 ref. (L16, 2-60; ST, *Al*)

710-L.* Aluminizing of Steels by the Aqueous Flux Process. S. M. Arora, P. K. Gupte and B. R. Nijhawan. *Indian Institute of Metals, Transactions,* v. 11, June 1958, p. 57-72.

Flux is applied by dipping the article in a strong, hot aqueous solution of potassium fluoride containing traces of hydrochloric acid. Drying of fluxed material leaves a protective, oxide reducing and air-excluding film of salt. Preheated articles are then dipped in the molten Al bath maintained between 710-760° C. and withdrawn after 15-30 sec. During hot dipping in molten Al, potassium fluoride reacts in the bath forming potassium cryolite which diffuses away to the surface allowing clean steel to come in contact with molten Al. 16 ref. (L16; ST, *Al*)

711-L.* (German.) **Surface Protection by Whirl Sintering and Flame Spraying.** Erwin Gemmer. *Werkstoffe und Korrosion,* v. 9, July 1958, p. 421-423.

Whirl sinter apparatus for dip coating of metals with thin plastic. Flame spraying a plastic powder on heated metal. Sand blasting, wash primer and chemical treatments for the preparation of surfaces. Pigmenting and coloring methods; automation of whirl sintering processes. (L26p, L10, L12)

712-L.* (German.) **New Protective Silica Coatings on Metal Surfaces.** O. Loebich. *Werkstoffe und Korrosion,* v. 9, July 1958, p. 423-424.

New silica coating "Inverron" for metal surfaces can be applied easily, is noncombustible and resists temperatures up to 400° C. Shows good chemical resistance and does not injure metal luster. (L26; *Si*)

713-L.* (Italian.) **Anodic Oxidation of Light Alloys and Architectural Applications.** A. M. Bertazzoli. *Alluminio,* v. 27, July-Aug. 1958, p. 331-336.

History of industrial use of anodic oxidation in Italy; process; common defects in anodic coatings and methods of inspection and control; standards and quality, responsibility of suppliers of anodized items.
(L19; Al)

714-L.* (Italian.) **"Victor Cromalugraf" Aluminum Printing Process.** *Alluminio,* v. 27, July-Aug. 1958, p. 342-344.

New decorative process can be used on bare Al in any of its possible finishes and on painted or anodized metal; provides permanent designs and colors for indoor and outdoor applications. Examples of architectural panels and smaller items for home, industry and office. (L26b, T26n; Al)

715-L.* Hard Oxide Coatings on Aluminum Investigated. *Industrial Finishing,* v. 10, July 1958, p. 36-37.

Effects of hard oxide coatings on properties of Al and its alloys. Corrosion resistance, abrasion resistance and stress-rupture tests were made. Effects of various coating treatments on abrasion resistance and effects of treatments on bending fatigue.
(L14a, Q9, R-general; Al)

716-L.* Application of Vitreous Enamels to Non-Porous Surfaces. *Industrial Finishing,* v. 10, July 1958, p. 47-49.

Ways of applying coatings and advantage of each. Types of coatings, including various decorative finishes. (L27)

717-L.* (Japanese.) **Studies on Aluminum Enameling. Pt. 3. Pretreatment of Aluminum Plate for Borosilicate System Frit.** Toshio Yamada and Shinichiro Tomino. *Metal Finishing Society of Japan, Journal,* v. 9, June 1958, p. 206-210.

Effect of anodic treatment of Al plates to aqueous solution of borates or silicates prior to application of enameled frit on adhesion of enamel, impact bending and thermal shock tests. Lithium borate, sodium borate, water glass and potassium borate were effective for anodic treatment. Binary mixtures such as lithium borate and water glass gave even better results. Ternary mixtures also were effective. 5 ref. (L27; Al)

718-L.* (Japanese.) **Electrodeposition on Anodic Coating of Aluminum. Pt. 5. Electron-Microscope Observation of Anodized Coating.** Matsuhei Kishi. *Metal Finishing Society of Japan, Journal,* v. 9, June 1958, p. 213-217.

Structure of anodic coatings produced by anodizing Al in phosphoric acid, oxalic acid and sulphuric acid. Influence of bath composition, bath concentration, voltage and treatment time on porosity and structure. 7 ref. (L19, M27; Al)

719-L.* (Japanese.) **Studies on Aluminum Enameling. Pt. 4. Effect of Li_2O on Borosilicate System Frit.** Toshio Yamada and Takashi Sugiyama. *Metal Finishing Society of Japan, Journal,* v. 9, June 1958, p. 217-222.

Effect of varying Li_2O content from 1 to 10% in enameling frit for Al on adhesion, wetting power, gloss, corrosion resistance and thermal shock resistance of the enamel. Enamel with larger amounts of Li_2O gave the best performance when subjected to impact, bending, thermal shock and corrosion tests. 4 ref. (L27, Q-general; Al)

720-L.* Babbitting of Cast Iron. *Foundry Trade Journal,* v. 105, Sept. 4, 1958, p. 295-296.

Kolene process removes sand, scale, rust and grease from castings, as well as dissolving the graphite on and immediately below the surface, creating a chemically clean surface for tinning.
(L12n; CI, SGA-c)

721-L.* New Hard Coat for Aluminum. *Steel,* v. 143, Sept. 22, 1958, p. 80-81.

Process gives porous oxide coating up to 0.006 in. thick, with wear resistance greater than anodized finishes. Costs slightly more than anodizing, less than Cr plating. (L14a, L19; Al)

722-L. Guide to Electrodeposited Coatings and Other Surface Treatments for Metals. D. E. Couch and J. W. Hensley. Naval Ordnance Test Station. *U. S. Office of Technical Services,* PB 131496, Sept. 1954, 29 p. $.75.

Quick, reliable guide to the properties and uses of electrodeposited metals and to other chemical and electrochemical treatments used in metal finishing. Rapid evaluation of electrodeposited metals and other surface treatments. Definition of terms. Characteristics of electrodeposits, electrodeposited coatings, special chemical and electrochemical processes and special coloring processes for decorative and photographic purposes.
(L17, Q-general)

723-L.* (Japanese.) **Hydrogen Overvoltage of Nickel-Phosphorus Electrodes in Alkali Solutions.** K. Sasaki and K. Sugiyama. *Chemical Society of Japan, Journal,* v. 61, June 1958, p. 650-655.

(*)Articles Available Through Photocopy Service; See Coupon, p. 75.

Electrodes prepared by the electroless method are used. Hydrogen overvoltage is observed in relation to time, current density and bath temperature. (L17; Ni)

724-L.* (Japanese.) **Experiments With Clear Lacquer Coating on Plated Zinc Die Castings.** Masahiro Uga. *Metal Finishing Society of Japan, Journal,* v. 9, June 1958, p. 210-213.

Variety of clear lacquers was applied to plated Zn die castings to compare adhesiveness and corrosion resistance of the lacquer coatings. A vinyl lacquer was found to be most practical. (L26n; Zn, 5-61, 8-12)

725-L. (Russian.) **Effect of Technological Factors on Porosity of Electrolytic Nickel Deposits.** G. S. Vasil'yeva. *Materialy po obmenu opytom i nauchnymi dostizhpniyami v meditsinskoi promyshlennosti,* no. 3, 1957, p. 31-42.

The effect of preliminary treatment (mechanical and chemical), composition of electrolyte and conditions of electrolysis on the porosity of Ni deposits. It was found that the better the mechanical treatment of the surface the less is the porosity. Passivation of the surface prior to Ni plating decreases the protective properties of the coating. Porosity is increased on contamination of the electrolyte with Fe and dextrin. (L17, 9-68; *Ni*)

726-L. Six Ways to Safeguard Good Appearance, Long Life. *Industrial Finishing,* v. 10, no. 121, July 1958, p. 28-29.

Cleaning methods during and after fabrication which safeguard the important qualities of stainless steel. (L10, L12, 17-52; SS)

727-L. Good Finishing Is 'Keynote' to Accuracy. *Industrial Finishing,* v. 10, no. 121, July 1958, p. 40-41.

Heat treating and various finishing processes used in producing a high-quality typewriter. (L-general, J-general, T10f, 1-61; ST, Ni)

728-L. Continuous Galvanizing of Steel Strip. *Metallurgia,* v. 58, Aug. 1958, p. 76-79.

New Armco-Sendzimir line installed at the Ebbw Vale works of Richard Thomas and Baldwins Ltd. (L16; *Zn,* ST; 4-53)

729-L. Which Finish for Zinc Diecastings? Roy Stricklen. *Metalworking Production,* v. 102, Aug. 15, 1958, p. 1431-1433.

(L-general; Zn, 5-61)

730-L. Glass-Protected Steel. *Product Engineering (Design Digest),* v. 29, Sept. 1958, p. C10-C11.

Corrosion prevention up to 1500° F., with good adhesion and dielectric properties. (L27; ST, NM-g34)

731-L. (German.) **Influence of Biologically Polluted Waters in Electroplating.** K. Sommer. *Metallwaren-Industrie und Galvanotechnik,* v. 49, Aug. 1958, p. 351-352.

Importance of proper filtration of water used in electroplating plants. Quick growing algae and fungi affect appearance (threadlike deposit under microscope) and quality of finishes. (L17, W10h, 9-71)

732-L. (Italian.) **Bonderizing of Light Alloys.** P. de Cerma. *Alluminio,* v. 27, July-Aug. 1958, p. 337-340.

(Li4b; Al, Mg, Ti)

733-L.* Choosing a Finish for Zinc Die Castings. Raymond Stricklen. *Precision Metal Molding,* v. 16, Sept. 1958, 67-69, 80.

Guide to mechanical finishing: polishing, buffing, tumbling and burnishing; chemical coloring and polishing; electroplating—zinc, zinc chromate, copper-nickel-chromium; organic lacquers and enamels. 5 ref. (L-general; Zn, 5-61)

734-L.* Metal Bonded Media for Barrel Finishing. *Precision Metal Molding,* v. 16, Sept. 1958, p. 74-75.

Mixture of abrasive and Cu powders was formed into pellets in a die and the resulting parts sintered. When pellets lodged in holes or channels they were easily removed by dissolving them in a solvent that would not attack the metal from which the part being polished was made. There was no noticeable fracturing, rate of media wear was slow, rate of cut was rapid and the surface finish produced was satisfactory. A comparison is made with aluminum oxide media. Superiority of the metal powder to produce small radii is clear. (L10d, W2a; NM-j)

735-L. The Nitric - Hydrofluoric Acid Pickling of Zircaloy-2. E. Burt Friedl, Warren E. Berry, Paul D. Miller and Frederick W. Fink. Battelle Memorial Institute. *U. S. Atomic Energy Commission, BMI-1270,* June 11, 1958, 34 p.

Acid concentration, bath contamination, and temperature investigated. Pickling rates were found to be linear with time. Contamination of the bath with metal ions found in Zircaloy-2 at concentrations below saturation also had little or no effect on the pickling rate. 3 ref. (L12g; Zr-b)

736-L. Descaling and Cleaning of Titanium and Titanium Alloys. D. S. Stough, H. S. George, E. B. Friedl, W. K. Boyd and F. W. Fink. Battelle Memorial Institute. *U. S. Office of Technical Services,* PB 121640, Mar. 1958, 68 p. $1.75.

Scales formed on Ti and Ti alloys that have been heated in air up to about 1100° F. are generally removed by acid pickle baths. More drastic treatment is usually required when the metal is heated in air to above 1100° F. Proprietary descaling methods. Descaling practices at the major producers of mill products, such as billet, bars, plate, and especially sheet. (L12; Ti)

737-L.* Uniform Coatings Put on by Pressure Curtain Application. P. C. Bardin. *Industrial Finishing,* v. 34, Sept. 1958, p. 8-16.

New method, called "pressure curtain", of applying protective and decorative coatings on flat, curved, concave, fluted or molded surfaces of wood, metal and plastic products is fast and economical. Principle of "pressure curtain" application and the machine. Through the thin curtain of flowing material the uncoated stock is moved by flat conveyor belts. (L26n, 1-52)

738-L.* Protective Coatings for Steel. Pt. 1. Louis J. Nowacki and E. R. Mueller. *Industrial Heating,* v. 25, Sept. 1958, p. 1810, 1812, 1814-1816.

Selection and application of organic coatings, or paints. Types of coatings classified and characteristics of specific materials in each category related to present applications. (To be continued.) (L26; ST)

739-L.* Special Finishes and Their Uses. B. M. Letsky. *Product Finishing,* v. 11, Sept. 1958, p. 46-53.

Formulation and applications of various types of industrial finishes using lacquers. (L26n)

740-L.* (German.) **Anodizing.** Filip Schutra. *Metallwaren-Industrie und Galvanotechnik,* v. 49, July 1958, p. 275-279.

Anodized parts present excellent base for lacquer, synthetic resins, organic and inorganic dies. Preparation of Al before anodizing; mechanical buffing, polishing, chemical treatment when used for decorative purposes. Preparation of material; proper mounting of parts; volume and condition of baths, rinsing. Direct-current sulphuric acid method used for pure Al and Al alloys with 15% Si, or up to 20% total of Cu, Mg, Mn or Zn. Coloring between anodizing and sealing. Done by dipping, alternating between two baths with thorough rinsing in between. Coloring with gold and bronze. 9 ref. (L19; L14; Al)

741-L.* (German.) **Metal Cleaning as Physico - Chemical Problem.** Paul Westphal. *Metallwaren-Industrie und Galvanotechnik,* v. 49, Aug. 1958, p. 312-320.

Complete cleaning means removal of all foreign matter (including oxides and other compounds of basic metal; metal chips and flakes; residues of polishing agents, oils and greases). Cleaning methods must be adapted to matter to be removed. Most material can be dissolved in related (heteropolar and homopolar) agents; for mixed group alkaline solutions can be used. Ideal cleaning solution would be one in which pickling, deoxidizing, degreasing and polishing (chemically or electrolytically) could be done at the same time. 8 ref. (L12)

742-L. (German.) **Degreasing of Metals in Plating Technology.** R. Weiner. *Metallwaren-Industrie und Galvanotechnik,* v. 49, Aug. 1958, p. 320-336.

Necessity of careful cleaning of metal surfaces; degreasing does not include removal of oxides and other compounds of basic metal but deals with removal from surface of "impurities" mostly resulting from preceding operations. If two degreasing procedures needed, second degreasing always done electrolytically. Two basic methods are dissolving and emulsifying. These are always supplemented by mechanical methods (movements of parts in dipping; bubbling effects in boiling solutions; steady flow of solutions around and over parts by way of pumps; spraying of solution on parts). Advantages and disadvantages of different methods. (L12, L17)

743-L.* (German.) **Degreasing and Cleaning of Steel Parts Before Applying Nonmetallic Coatings.** H. Rogner. *Metallwaren-Industrie und Galvanotechnik,* v. 49, Aug. 1958, p. 337-342.

Alkaline solutions (inorganic salts mostly supplemented by soaps and emulsifiers) and organic solutions or solution compounds are used for degreasing; for deoxidizing and acid substances. Passivating agents may

be acid, alkaline or neutral. For deoxidizing and rust removing the cheapest agents are hydrochloric acid and sulphuric acid, supplemented by inhibitors; sometimes phosphoric acid is used which forms a protective layer on surface. (L12; ST)

744-L.* High Speed Brass Plating. E. J. Roehl. *Electroplating and Metal Finishing,* v. 11, Sept. 1958, p. 299-301.

New process for plating brass on steel strip is capable of operation at substantially higher speeds. Brass-coated and lacquered strip steel is used for the fabrication of hand-bag frames, curtain rods, pencil ferrules, etc. (L17; ST, Cu-n)

745-L.* Hot Galvanizing Practice in the U. S. A. A. T. Baldwin and W. H. McMullen. *Electroplating and Metal Finishing,* v. 11, Sept. 1958, p. 319-322.

Production of better coatings and a reduction in the amount of Zn lost in dross by-products. New methods to increase ductility, adherence and appearance of the coatings. (L16, 1-66; *Zn*)

746-L. Diffusion of Aluminum and Beryllium in Nickel and Nickel Alloys. H. Buckle and J. Moisan. *Engineers' Digest,* v. 19, Aug. 1958, p. 336-338.

New diffusion process by means of which surface layers of definite compounds of Al and Be (AlNi, $AlNi_3$, and BeNi, Be_2Ni) can be applied on Ni. Behavior of these layers at high temperatures in air and in the presence of combustion gases. 7 ref. (L15; Ni, *Be, Al*)

747-L. The Use of Hard Chrome Plating in Engineering. Cyril Wharrad. *Inspection Engineer,* v. 22, July-Aug. 1958, p. 74-79.
(L17; *Cr*)

748-L. New Pretreatment Thwarts Rust. H. W. Adams. *Iron Age,* v. 182, Sept. 18, 1958, p. 86-87.
(L12, R10b)

749-L. Uses Grow for Ceramic Coatings. F. D. Shaw. *Iron Age,* v. 182, Sept. 25, 1958, p. 94-95.
(L27)

750-L. Ten Painting Reminders for Steel Plants. Walter T. Yarhouse. *Iron and Steel Engineer,* v. 35, Sept. 1958, p. 129-141.

Techniques and table listing resistance of several paints to acids, alkalis, and various ambient conditions. (L26n; ST)

751-L. Racking and Masking Techniques for Metallic Deposition by High Vacuum. J. Gordon Seiter. *Plastics Industry,* v. 16, Sept. 1958, p. 38-42.
(L25g)

752-L. Bright Nickel Plating in India. *Product Finishing,* v. 11, Sept. 1958, p. 54-55.

First automatic machine for bright Ni plating.
(L17b; Ni-b, Cr, Cu)

753-L. Productivity of Finishing Operations. *Product Finishing,* v. 11, Sept. 1958, p. 56-60, 79.

Finishing operations on mobile cranes, bike prop stands, baby carriages and wheels, and slotted angle metal. (L26n)

754-L. Ultrasonics in Finishing. D. J. Fishlock. *Metal Industry,* v. 93, Aug. 8, 1958, p. 109-113.
(L10f)

755-L. Architectural Anodized Aluminum—Recommended Processes for Light-Fast Weather-Resistant Coatings. *Metal Industry,* v. 93, Sept. 5, 1958, p. 193-196.
(L19, T26n; Al-b)

756-L. Influence of Surface Characteristics of Tinplate on Dewetting by Lacquer. S. C. Britton and K. Bright. *Sheet Metal Industries,* v. 35, Sept. 1958, p. 679-684.
(L26n; *Sn,* 8-70)

757-L. (Book.) **Industrial Finishing Yearbook, 1958.** 248 p. 1958. Arrow Press Ltd., 1 Stamford St., London S. E. 1, England. 15 sh.

Technical handbook, buyers' guide and directory. (L-general)

M Metallography

Constitution and Primary Structures

487-M. Methods of Preparation and Examination of Surfaces. G. L. Bailey. Paper from "Effect of Surface on the Behaviour of Metals", Philosophical Library, 1958, p. 3-25.

For studying the shape, or topography, of surfaces; studying their structure, both on the microscopic and atomic scales; and determining the composition of surfaces. Application of electron microscopy, field emission microscopy and electron diffraction. 10 ref.
(M27, M25, S15, M21, M22)

488-M. Identity Period of the Lattice of Pure Vanadium and Effect of Oxygen on It. M. A. Gurevich and B. F. Ormont. *Physics of Metals and Metallography,* v. 4, no. 1, 1957, p. 88-90. (Translation by Pergamon Institute.)

A method of determining oxygen, dissolved in V, based on change it induces in the lattice constant, is proposed; figures tabulated for this change. 13 ref. (M26, S11g; V-a, *O*)

489-M.* (French.) **Quantitative Study of Dendritic Heterogeneity in Iron Alloys.** Christian de Beaulieu and Jean Philibert. *Comptes Rendus,* v. 246, June 30, 1958, p. 3615-3618.

Variation of concentration between dendritic axes and interdendritic spaces observable by means of autoradiography can be determined quantitatively by pinhole studies made with Castaing micro-analyzer. It is then possible to standardize information obtained. In presence of carbon, elements are classified in following order of increasing heterogeneity: Mn, Cr, Mo, As.
(M27, N12b, M23q, Fe-a, *Mn, Cr, Mo, As*)

490-M.* (French.) **Superstructure in a Ti-Al 15% Alloy.** Adrien Saulnier and Maurice Croutzeilles. *Comptes Rendus,* v. 246, June 30, 1958, p. 3622-3625.

Electron micrographic and electron diffraction studies showed existence of an ordered compact hexagonal phase which is a Mg_3Cd type superlattice of the alpha solid solution. This phase appears in submicroscopic platelets parallel to faces {1010} of the solid solution. 5 ref.
(M27b; Ti-b)

491-M.* (French.) **Relationship Between the Purification of Aluminum and Its Susceptibility to Etching Reagents.** Gerard Wyon and Paul Lacombe. *Comptes Rendus,* v. 246, June 30, 1958, p. 3625-3628.

To confirm hypothesis that role of iron in etching of Al is decisive, a simple technique of purification by high vacuum melting and progressive solidification was developed, providing an almost totally pure specimen. Micrographic study of treated specimens confirmed effectiveness of elimination of iron impurity; grain subboundaries did not show etch figures. 15 ref.
(M27, M20q; Al-a, *Fe*)

492-M. (Russian.) **X-Ray Investigation of the Plasticity of Single Crystals of Beryllium.** R. I. Garber, I. A. Gindin, V. S. Kogan and B. G. Lazarev. *Izvestiia Akademii Nauk SSSR, Seriia Fizicheskaya,* v. 20, no. 6, 1956, p. 639-640.

X-ray diffraction, metallography and microinterferometry used to investigate single crystals of Be cut in the form of rectangular parallelepipeds, with one of the faces aligned with the plane of the base. Specimens were deformed by unilateral compression at temperatures from −253 to 800° C.
(M26, Q24; Be, 14-61)

493-M. (Russian.) **X-Ray Diffraction Investigation of the Surface Quality of Metals Treated by Grinding and Fine Cutting.** Yu. S. Terminasov, A. G. Yakhontov and A. V. Poltavskiy. *Izvestiia Akademii Nauk SSSR, Seriia Fizicheskaya,* v. 30, no. 6, 1956, p. 689-692.

X-ray diffraction (using the broadening and attenuation of the interference lines) and microhardness method used to study dependence of intensity of hardening on the metal surface and the distribution of hardening through the surface layer on the technological treatment conditions. Grinding or lathe cutting strengthens the surface layer of the metal, this being evidenced by an increase in the microhardness of 30 to 70%, a broadening of the diffraction lines by 100 to 200% and a reduction in the relative intensity of the lines by 40 to 70%, depending on the working conditions.
(M22g, Q23a, G17)

494-M. (Russian.) **Some Physical-Chemical Properties of Zirconium and Carbon Alloys.** G. V. Samsonov and N. S. Rozinova. *Izvestiia Sektora Fiziko Khimicheskogo Analiza Institut Obshchei i Neorganichesko Khimii imeni Akademiia Nauk SSSR,* v. 27, 1956, p. 126-132.

Roentgenographic and metallographic research and study of microhardness and electric conductivity established that Zr alloys containing 0.64 to 3.12% C by weight were two-phase alloys. The basic (hexagonal) phase is a solid solution of C in Zr, and the second (cubic) phase is a Zr carbide. Alloys containing 3.50 to 11.62% C are one-phase alloys and Zr carbides with the ZrC composition as a limit. Lattice spacing is given.
(M24b; Zr, C)

495-M. (Russian.) **Study of System Fe-Si Within the Range of Compound $FeSi_2$.** N. Kh. Abrikosov. *Izvestiia Sektora Fiziko Khimicheskogo Analiza Institut Obshchei i Neorganicheskoi Khimii imeni Akademiia Nauk SSSR,* v. 27, 1956, p. 157-163.

A part of the system Fe-Si in the range of leboite formation (phase of variable composition on $FeSi_2$ base) studied by thermal analysis, microstructure research, X-ray

(*)Articles Available Through Photocopy Service; See Coupon, p. 75.

phases and thermo-emf. measurement of alloys hardened at 900 and 1000° C. A polymorphous transformation of $FeSi_2$ at 960-995° C. was discovered. (M24b; Fe, Si)

496-M. (Russian.) **Electron Diffraction Investigation of the Degree of Perfection of Germanium Single Crystals.** S. A. Seniletov and Z. G. Pensker. *Kristallografiya*, v. 1, no. 2, 1956, p. 209-213.

Crystals were ground with corundum powder or etched in boiling hydrogen peroxide. Electron diffraction patterns produced with ground crystals displayed Debye rings and spots, thus showing that when Ge is ground individual blocks are formed in the surface layer, turned by angles of approximately 2 to 3° C. relative to each other (mosaics) and minute crystals are torn off the surface. Individual blocks, forming in grinding (mosaics), penetrated to the crystal at a depth of 40 to 80 microns. (M26n, M22h; Ge, 14-61)

497-M. (Russian.) **Electron-Diffraction Investigation of the Structure of Thin Layers of Cadmium Sulphide, Selenide and Telluride.** S. A. Semiletov. *Kristallografiya*, v. 1, no. 3, 1956, p. 306-310.

Using point electron diffraction patterns, obtained from CdS, CdSe and CdTe films, various types of orientations of crystals of these compounds have been established relative to rock salt and mica. All the samples disclosed the presence of crystals of both modifications of the substances investigated, this being explained by the small difference in the lattice energy of these modifications. (M26q, M26r, M22h; Cd)

498-M. (Russian.) **Study of System Copper-Magnesium-Tin in Range of $Cu-Cu_2Mg-CuMgSn$.** Ye. Cherkashin, Ye. I. Gladyshevskiy and M. Yu. Teslyuk. *Izvestiia Sektora Fiziko Khimicheskogo Analiza Institut Obshchei i Neorganicheskoi Khimii imeni Akademiia Nauk SSSR*, v. 27, 1956, p. 212-216.

Structure of the system was studied microscopically and by X-ray. Alloys of the cross-section $Cu_2Mg-CuMgSn$ are homogeneous in the range of 0 to 15 at.% Sn; along the cross-section Cu_2Mg-Sn the maximum solubility is 12 at.% Sn. The compounds Cu_2Mg and Cu_4MgSn do not produce any continuous series of solid solutions. The data of Sn solubility in Cu_2Mg are compared with the data of solubility of Be, Zn, Cd, Al, Si, Pb and Sb in Cu_2Mg and Cu. (M24c; Cu, Mg, Sn)

499-M. (Russian.) **Phase Composition and Phase Homogeneity Limits of Vanadium-Carbon Oxygen System. Pt. 1. Vanadium-Carbon System.** M. A. Gurevich and B. F. Ormont. *Zhurnal Neorganicheskoi Khimii*, v. 2, no. 7, 1957, p. 1566-1580.

Previously abstracted from original. See item 375-M, 1957. (M26r; V)

500-M.* **Further Observation on Grain Boundary Melting.** F. Weinberg. *Acta Metallurgica*, v. 6, Aug. 1958, p. 535-538.

Melting behavior of grain boundaries in bicrystals of Al and Zn. The melting temperature of the boundary was the same as that of the bulk material within an experimental uncertainty of 0.05° C. for Al and 0.02° C. for Zn. Bicrystals of Zn separated at the boundary before appreciable melting of the component crystals for boundary angles between 26 and 108°. Boundary melting and possibly boundary energy are significantly affected by the position of the boundary. (M27f, N3; Al, Zn)

501-M.* **Deformation Texture in Cold Drawn Nickel Rods.** K. Tangri and D. S. Eppelsheimer. *Indian Institute for Metals, Transactions*, v. 11, June 1958, p. 19-25.

New X-ray diffraction technique of texture determination which permits complete pole figure coverage with only one diffraction specimen. Deformation textures in 20.6, 40.5 and 60% cold drawn Ni rods are determined with the corresponding pole figures. The preferred orientation in cold drawn Ni may be described as a double fiber texture with [111] and [100] directions aligned along the fiber axis of the drawn rod. 5 ref. (M26c, M22g; Ni)

502-M.* (French.) **Improvements and New Applications of the Technique of Nondestructive Metallographic Examination.** P. A. Jacquet. *Revue de Metallurgie*, v. 55, June 1958, p. 531-554.

Electrolytes recommended for local polishing with buffer and how to use on cuprous metals, carbon steels, 18-8 stainless, light alloys, Mg alloys, Ti, U and Zr. Use of buffer in electrolytic etching. New, faster methods of drying replicas; improved techniques and materials for separation and mounting. Technique for preparation of replicas of small-diameter (2-mm.) wire. 18 ref. (M20)

503-M.* (Italian.) **A New Metallographic Etchant for Steels.** R. M. Corelli. *Rassegna Chimica*, v. 10, Mar-Apr. 1958, p. 18-19.

Slow-acting solution of monochloroacetic acid and ethyl alcohol is more efficient than customarily used solutions in revealing structural constituents of ferrous alloys. (M20q; ST)

504-M. (Russian.) **Electron Diffraction Investigation of Alloys of Bi and Sb and of Certain Oxides of These Elements.** Z. G. Pinsker, O. S. Orekhvo and A. I. Miller. *Kristallografiya*, v. 1, no. 2, 1956, p. 239-240.

Electron diffraction investigation of thin layers of Bi and Sb, obtained simultaneously by condensation of vapors in vacuum at temperatures ranging from room temperature to approximately 100° C., disclosed an identical structure, corresponding to Sb or Bi with a lattice period a continually varying from 4.53 ± 0.01 (Bi) to 4.29 ± 0.01 A, and a period c varying 11.88 ± 0.02 to 11.24 ± 0.02 A. Annealing of specimens of all compositions at 200° C. for 15 hr. does not change the diffraction pattern, thus evidencing that it is impossible to attain order in the arrangement of the Bi and Sb atoms. (M22h; Bi, Sb)

505-M.* (English.) **Light-Figure Phenomena Revealed and Crystal Faces Developed by Chemical Etching in Copper and Alpha-Brass Crystals.** Mikio Yamamoto and Jiro Watanabe. *Tohoku University, Science Reports of the Research Institutes*, v. 10, no. 3, June 1958, p. 240-250.

Light-figure phenomena of single crystals of Cu and alpha-brass etched with various chemical reagents. Crystal phases developed by etching; applicability of light figures for determination of crystal orientation. 5 ref. (M20q, M23; Cu, 14-61)

506-M. (Russian.) **Physicochemical Properties of Boron-Carbon Alloys.** G. V. Samsonov, N. N. Zuravlev and I. G. Amnuel'. *Fizika Metallov i Metallovedenie*, v. 3, no. 2, 1956, p. 309-313.

X-ray and microscopic study, as well as measurement of electrical resistance and density of boron-carbon alloys with 5 to 72.5% C. Above 5% C, an imperfect structure of the carbide $B_{13}C_2$ developed, which was characterized by vacant places on the c-axis in the $B_{13}C_2$ lattice. (M26r; B, C)

507-M. (Russian.) **Activity of Sodium in Alloys of Ternary System Tin-Sodium-Zinc.** A. G. Morachevskiy. *Nauchno-Tekhnicheskii Informatsionnyi Byuleten' Leningradskogo Politekhnicheskoko Instituta*, no. 3, 1957, p. 12-19.

Activity was computed using the results of measurement of the emf. of concentration chains of the amalgam type. Water glass (3.8% Na_2O) was used as the electrolyte. Small amounts of Zn do not essentially influence the activity factor of Na in alloys with Sn. The activity factor of Na starts to rise noticeably at the increase of Zn concentration. (M24c; P12b; Sn, Zn, Na)

508-M. (Russian.) **Mechanism of Formation of Through Impact Figures in Zinc.** A. A. Urusovskaya. *Trudy Instituta Kristallografii, Akademii Nauk, SSSR*, v. 12, 1956, p. 180-185.

When the surface of the base of a single crystal of Zn is struck with a needle, a hexahedral cavity appears, outlined by tracks of twin streaks. On the opposite side of the plate, a hexagonal pyramidal projection appears, turned relative to the crater on the upper surface by an angle of 30°. If the outline of the cavity on the surface of the base on which the impact is made corresponds to the tracks of the planes of a pyramid of the first kind (1012), then the outline of the projection corresponds to the trace of the planes of a pyramid of the second kind (1122). (M26n, Q6; Zn, 14-61)

509-M. (Russian.) **Constitution Diagram and Properties of Alloys of the System Ni-Ti.** L. I. Pryakhina. *Trudy Instituta Metallurgii, Akademiia Nauk SSSR*, v. 2, 1957, p. 119-125.

System investigated by microstructure, specific electric resistivity, and hardness. A region of limited gamma solid solution of Ti in Ni is established at 800° C. The curve of solubility of Ti and Ni at 800° C. passes between the compounds with 8 and 10.8% Ti. Diagrams of composition versus electric resistivity, hardness and refractoriness plotted and studied for alloys of the Ni-Ti system (containing up to 16% Ti). (M24b; Ni, Ti)

510-M. (Russian.) **Investigation of Alloys of the System Ag-Mn-Al.** D. A. Petrov and A. Ya. Potemkin. *Zhurnal Neorganicheskoi Khimii*, v. 2, no. 7, 1957, p. 1552-1565.

Constitution diagram was plotted for the Ag-corner of the system Ag-Mn-Al up to 10% Al and up to 30% Mn. The liquidus surface consists of three fields of primary crystallization of phases alpha, beta and Mn. There exist three nonvariant equilibriums in the Ag-corner of the Ag-Mn-Al system. Saturation limits of the alpha solid solution in a silver base determined

approximately; distribution of the phase regions at temperatures of 700, 600, 400, 200 and 20° C. Properties of the alloys of Ag with Mn and Al; electric resistivity and hardness depend on composition of the alloys. (M24c; Ag, Mn, Al)

511-M.* Microscopic Observations of the Surface of InSb Monocrystals. J. Auleytner and B. Kolakowski. *Acta Physica Polonica,* v. 17, 1958, p. 93-109.

Observations of etched and cleaved surfaces with crystallographic indices (100), (111) and others. Shape of the etch pits is different for the various crystallographic surfaces. Two types of etched figures were observed; they differ in size and in density. 7 ref. (M26s; In, Sb)

512-M.* Structure of Epitaxed Copper Deposited by Evaporation Onto a Clean (00.1) Face of a Titanium Crystal. R. E. Schlier and H. E. Farnsworth. *Physics and Chemistry of Solids, Journal,* v. 6, Aug. 1958, p. 271-276.

Titanium crystal was cleaned by heating, ion bombardment and annealing in high vacuum. Low-energy electron diffraction was used to determine that the surface was essentially free of contamination and to make structure determinations. The Cu deposits varied in average thickness from 0.5 to 25 atomic layers. The Cu formed at nucleation centers in the form of discrete oriented crystallites with a lattice spacing parallel to the substrate which was the same as that of the (111) plane in the bulk Cu and with the (110) azimuth of Cu parallel to the (11.0) azimuth of Ti. 11 ref. (M26; Cu, Ti)

513-M.* Some Grain Boundary Characteristics in Babbitt and Tin. P. G. Deo and B. D. Sharma. *Scientific and Industrial Research, Journal,* v. 17, July 1958, p. 248-251.

Polycrystalline babbitt and Sn etched under cathodic sputtering and by chemical means are examined by high-resolution microscopy and multiple-beam interferometry. Comparative results obtained on the grain boundaries of cast surfaces indicate that these level differences are due to the deformation of the grains caused by the temperature variation. 5 ref. (M21c, M27f; Sn, Sb)

514-M.* (Czech.) **Practical Possibilities of the Use of Lattice Quantitative Metallographic Analysis.** Zdenek Ministr. *Hutnicke Listy,* v. 13, no. 7, 1958, p. 598-603.

Quantitative metallographic analysis in addition to its own relative errors has inaccuracies depending upon resulting capacity and focusing. Special reference to porous materials. Examples of conversion of volume parts to weight parts in two or more component structures. (M23)

515-M. (Russian.) **X-Ray Diffraction Investigation of Several Alloys of Transition Metals With Silicon.** Ye. I. Gladyshevskiy, P. I. Kripyakevich and Yu. B. Kuz'ma. *Fizika Metallov i Metallovedenie,* v. 2, no. 3, 1956, p. 454-456.

Investigation was made of sections of Mn_5Si-Fe_5Si, Mn_5Si-Co_5Si, Mn_5Si-Ni_5Si, and Mn_5Si-Cu_5Si. The Mn_5Si and Fe_5Si compounds form with each other a continuous series of solid solutions. In the Mn-Co-Si system there was found a Co_2MnSi compound of a CsCl-type ($a = 2.827 \pm 0.001$ kX). No triple compounds of the types CsCl, BiF_3 or Cu_2MnAl are observed in the Mn-Ni-Si and Mn-Cu-Si systems. (M24, M22g; Si)

516-M. (Russian.) **Study of Alloys of Gold-Cobalt System.** A. T. Grigor'yev, Ye. M. Sokolovskaya and M. V. Maksimova. *Zhurnal Neorganicheskoi Khimii,* v. 1, no. 5, 1956, p. 1047-1051.

Studied by thermal analysis, microstructure, hardness and electric resistance. Au with an admixture content under 0.01% and Co containing 0.01% carbon were used as initial materials. Au and Co produce a simple graph with a eutectic at 10% Co and temperature of 995° C. The solubility of Co in Au and of Au in Co is 8 and 6% at 995° C. and 5 and 5% at 900° respectively. (M24b; Au, Co)

517-M. Beta-Wolfram Structure of Compounds Between Transition Elements and Aluminum, Gallium and Antimony. E. A. Wood, V. B. Compton, B. T. Matthias and E. Corenzwit. *Acta Crystallographica,* v. 11, Sept. 10, 1958, p. 604-606.
13 ref. (M26q; Al, Sb, Ga)

518-M. The Crystal Structure of a M_2B_5-Type Double Boride. H. J. Beattie, Jr. *Acta Crystallographica,* v. 11, Sept. 10, 1958, p. 607-609.

A new boride structure has been found in alloys HS-88 and Incoloy 901, each with around 0.1% B addition. The borides were extracted electrolytically from unaged specimens and examined by X-ray powder analysis. Small amounts of TiC were also present in both extracts. Incoloy 901 without B does not produce this structure. (M26r, Ni-b, *B*)

519-M. On the Distribution of Impurity Atoms in the Stress Field of a Dislocation. D. N. Beshers. *Acta Metallurgica,* v. 6, Aug. 1958, p. 521-523.

Impurity atoms distributed in the stress field of a dislocation obey Fermi-Dirac statistics. Result is applied to two experimental situations. The binding energy of an impurity to a dislocation is determined. 5 ref. (M26b, 3-69)

520-M. X-Ray Diffraction Studies of a Binary Alloy Containing Metals With Dissimilar Crystal Structures, Valences and Ionic Radii. G. P. Chatterjee, J. K. Mukherjee and K. C. Som. *Indian Institute of Metals, Transactions,* v. 9, 1955-1956, p. 219-225.

Forms of the intermetallic compound Cu_2Mg are interpenetrating type f.c.c. structure with 8 molecules per cell. The lattice structure is similar to but not exactly like the f.c.c.-ZnS type; the lattice parameter is $a_0 = 7.064$ Å; the lattice bond of Cu_2Mg is not truly metallic. 4 ref. (M26q, Cu, Mg)

521-M. Studies on Surface Structure by Electron Diffraction. A. Goswami. *Indian Institute of Metals, Transactions,* v. 9, 1955-1956, p. 227-236.

Surface structure and crystal growth process in electrodeposition, oxidation reaction and corrosion phenomena. 18 ref. (M22h, N12d, R1)

522-M. Electron Microscopy. A. R. Deo and M. K. Gharpurey. *Indian Institute of Metals, Transactions,* v. 9, 1955-1956, p. 237-245.

Techniques of specimen preparation. Plastic replicas give poor resolution. Silica replicas as well as anodic aluminum oxide replicas permit a resolution of about 100 Å, while with carbon a resolution better than 50 Å has now been reported. 11 ref. (M20r, M21e)

523-M. Interfaces Between Metallic Crystal Grains. G. P. Chatterjee. *Indian Institute of Metals, Transactions,* v. 9, 1955-1956, p. 275-284.

Relationships between temperature, surface tension and composition of homogeneous binary alloys considered thermodynamically. 8 ref. (M27b)

524-M. Preparation of Tin and Tin Alloys for Micro-Examination. B. L. Eyre. *Metallurgia,* v. 58, Aug. 1958, p. 95-106.

Techniques used at the Tin Research Institute, based on conventional grinding and polishing techniques, using specially selected abrasives and polishing cloths. Diamond abrasives are employed for the major part of the fine polishing. 13 ref. (M20p; Sn)

525-M. (German.) **Screw Dislocation in Alkali Metals Treated According to Lattice Theory.** Chr. Lehmann and G. Liebfried. *Physics and Chemistry of Solids,* v. 6, Aug. 1958, p. 195-204.
10 ref. (M26b)

526-M. (Russian.) **Nonferrous Metallography With Polarized Light.** V. S. Ermakov. *Zavodskaya Laboratoriya,* v. 24, no. 7, 1958, p. 838 + 4 p. of illustrations.
6 ref. (M21c; EG-a38)

527-M. (Russian.) **Appearance of Low-Carbon Steel Structure After Electrolytic Polishing and Etching.** B. S. Kasatkin. *Zavodskaya Laboratoriya,* v. 24, no. 7, 1958, p. 842-843.
4 ref. (M21c; CN-g)

528-M.* Activities in the Chromium-Nickel System. M. B. Panish, R. F. Newton, W. R. Grimes and F. F. Blankenship. *Journal of Physical Chemistry,* v. 62, Aug. 1958, p. 980-982.

Chromium activities in the Ni-Cr system were obtained from the potentials between Cr and alloy electrodes in an electrolyte of molten NaCl-RbCl mixture containing about 0.5% $CrCl_2$. Seven alloy compositions ranging from 11 to 96 at. % Cr were studied at 750° and the 53 and 96% alloys also at 965°. The activity coefficient of Cr at 750° ranges from about 0.5 to 1.0 as the Cr concentration increases to 30%, then increases sharply as the miscibility limit at 40% is approached. (M24b, P12b; Ni, Cr)

529-M. The Uranium-Nitrogen-Carbon System. Alfred E. Austib and Arnold F. Gerds. Battelle Memorial Institute. *U. S. Atomic Energy Commission BMI-1272,* June 23, 1958, 18 p.

System studied at 1800° C. under vacuum and under a 1-atm. nitrogen pressure. There is complete solid solubility between UN and UC, and essentially no solid solubility of nitrogen in UC_2 or U_2C_3 or of carbon in U_2N_3. 9 ref. (M24c; U, N, C)

530-M.* (English.) **Oxidation Method of Determining Austenitic Grain Size in Mild Steel.** P. Szeki. *Acta Technica,* v. 21, no. 1-2, 1958, p. 79-86.

(*)Articles Available Through Photocopy Service; See Coupon, p. 75.

Simple method developed austenitic grain boundaries within 20 to 25 min. by heating prepared metallographic specimens in a tubular furnace in a stream of industrial nitrogen. Oxygen present in the industrial gas oxidizes grain boundaries of austenite. Method used to investigate austenitic grain size of a mild steel at 970 to 1170° C. The temperature of austenitic grain coarsening and the calculated solution temperature of AlN were in good accord. 4 ref.
(M23r, M27c; CN)

531-M.* Study of Non-Metallic Inclusions in Castings, Using a Radioactive Tracer. B. B. Gulyaev. *Foundry Trade Journal*, v. 105, Sept. 18, 1958, p. 341-344.

Previously abstracted from original. See item 418-M, 1956.
(M27, 1-59, E11)

532-M. Electron Metallography of the Al-Ni-U Bond. Carl L. Angerman, E. I. du Pont de Nemours & Co. *U. S. Atomic Energy Commission, DP-248*, Dec. 1957, 22 p. (Available from U. S. Office of Technical Services, Washington 25, D. C.) $1.75.

The diffusion zones formed during the bonding of Ni plated U cores to Al sheaths were identified by correlating the appearance of these zones with those identified in diffusion couples. A relationship between the structure and the strength of the bond was observed. 13 ref. (M21e, K5k, Ni; Al, U, *Ni*)

533-M. Measurement of the Absolute Energy of Low-Angle Dislocation Boundaries in Zinc. R. B. Shaw, T. L. Johnston, R. J. Stokes, J. Washburn and E. R. Parker. California University Institute of Engineering Research. *U. S. Office of Technical Services*, PB 126531, May 1956, 32 p. (Available at Library of Congress, Washington, D. C.) Microfilm $3, photocopy $6.30.

Theoretical study on dislocation boundaries, combined with microscopic examination of a low-angle boundary in a small tapered Zn crystal which was heated to within a few degrees of the melting point. (M26b, P12; Zn)

534-M.* (German.) **Rolling Textures of Transformer Sheet.** Hermann Moeller and Helmut Staeblein. *Archiv für das Eisenhüttenwesen*, v. 29, June 1958, p. 377-390.

Using a Geiger counter X-ray diffraction goniometer of an improved design with monochromatic radiation from lithium fluoride the cold, hot and cross rolling textures of steel with 2.65% and 2.85% Si were investigated and pole figures were determined. Both strain and compression textures were found, verifying former observations. Through the utilization of monochromatic radiation a better relation between line intensity and background was obtained, eliminating the distorting effects of influence. 36 ref.
(M26c, F23; AY, Si, SGA-n)

535-M.* (German.) **Cubic Position as a Recrystallization Texture in Iron-Silicon Alloys.** Hans-Eberhard Mobius and Franz Pawlek. *Archiv für das Eisenhuttenwesen*, v. 29, July 1958, p. 423-437.

Formation of perfect cubic positions in the secondary recrystallization process from a prepositional structure in the (110) [001] and (100) [001] planes is observed step by step. The influence of Si content (1.8 to 2.2%) and intermediate heat treatments upon formation of the texture is analyzed. 24 ref.
(M26c, N5; Fe, *Si*)

536-M.* (German.) **Recrystallization Texture in Cold-Rolled Transformer Sheet.** Helmut Staeblein and Hermann Moller. *Archiv für das Eisenhüttenwesen*, v. 29, July 1958, p. 433-447.

X-ray photographs were taken and pole figures developed in the (110) and (200) planes on primary and secondary recrystallization textures of materials with 0.052% and 0.011% C and 2.65% Si. The influence of rate of deformation, annealing temperature between 500 and 1300° C. and carbon contents particularly upon the texture [100] (011). 39 ref. (M26c, N5; ST, SGA-n)

537-M.* (German.) **New Observations on Sub-Grains of Aluminum.** Dietrich Altenpohl. *Zeitschrift für Metallkunde*, v. 49, June 1958, p. 331-342.

Sub-grains were observed on Al by means of X-rays as well as light and electron microscopes. Sub-grains of 1 micron appear mainly after plastic deformation of polycrystalline structures. At 183° C. no sub-grains were observed. Apparently in the recrystallized state an accumulation of impurities along the sub-grain boundaries takes place, consisting of iron and hydrogen and probably copper atoms. Various theories on the development of sub-grain structures. 45 ref.
(M27c; Al)

538-M.* (Polish.) **Thermodynamic Characteristic of Intermetallic Phases of the Daltonide and Berthollide Type.** Janusz Terpilowski and Wlodzimierz Trzebiatowski. *Archiwum Hutnictwa*, v. 3, no. 2, 1958, p. 97-112.

Electrochemical data were used to calculate changes of such partial molal thermodynamic values as thermodynamic potential, entropy and enthalpy for the less noble components within the range of intermediate phases for the metallic systems: Ag-Cd, Au-Cd, Cu-Zn, Bi-Tl and Pb-Tl. On the basis of previous work it was found that calculated thermodynamic values in the limits of existence of the beta and epsilon phases for Au-Cd system and gamma phase for systems Ag-Cd, Cu-Zn were characteristic for phases of the daltonide types. Remaining phases were Berthollide type. 36 ref. (M26q, P12; Ag, Cd, Au, Cu, Zn, Bi, Tl, Pb)

539-M.* The Aluminum-Rich End of the Aluminum-Vanadium System. D. M. Bailey, O. N. Carlson and J. F. Smith. *American Society for Metals, Transactions*, v. 51, Preprint no. 81, 1958, 6 p.

Aluminum-vanadium phase diagram revised on the basis of additional X-ray and thermal data. A new intermetallic compound, α' (Al-V), with a formula close to that of Al_7V, was found to undergo peritectic decomposition at 688° C. A peritectic horizontal was established at 661.9° C. in the Al-rich end of the diagram. 10 ref.
(M24b; Al, V)

540-M.* Lattice Parameters of Uranium From 25 to 1132° C. P. Chiotti, H. H. Klepfer and R. W. White. *American Society for Metals, Transactions*, v. 51, Preprint no. 83, 1958, 12 p.

Lattice parameters of U were measured by X-ray diffraction techniques over the range from room temperature to 1060° C. Atomic volume and density as functions of temperature. The change in volume for the alpha-beta transformation was calculated to be 1.12% and for the beta-gamma transformation, 0.70%. 13 ref.
(M26, 2-61, N6p; U)

541-M.* The Constitution of Rhenium-Tungsten Alloys. J. M. Dickinson and L. S. Richardson. *American Society for Metals, Transactions*, v. 51, Preprint no. 88, 1958, 12 p.

Constitutional diagram proposed. Two intermediate phases were found. Sigma phase formed peritectically at 3000° C. and chi phase formed peritectoidally at 2125° C. A eutectic was found at 74% Re and 2825° C. W dissolved up to 37% Re and Re up to 20% W. 5 ref. (M24b; Re, W)

542-M.* Metallographic Identification of Inclusions in Uranium. George L. Kehl, Eric Mendel, Emilio Jaraiz F. and Melvin H. Mueller. *American Society for Metals, Transactions*, v. 51, Preprint no. 100, 1958, 14 p.

Identification of UN, U(C,N), UC, UO, UH_3, UO_2 and U_6Fe. True identity of various inclusions established by removing the inclusion with ultrasonic "jack hammer" and subjecting debris so created to X-ray diffraction analysis. Metallographic examination established on the basis of time required to electroplate the inclusions with Cu and on the character of the Cu deposits. 8 ref. (M23, M22g; U, 9-69)

543-M.* An X-Ray Metallographic Study of Arc-Cast Tungsten. Sam Leber. *American Society for Metals, Transactions*, v. 51, Preprint no. 103, 1958, 12 p.

Double crystal X-ray diffraction camera techniques can be used to provide a complete analysis of the distortions of the lattice planes within crystals. Data obtained from two arc-cast tungsten grains are used to describe the modes of distortion, misorientations across subboundaries, character of subboundaries, etc. An X-ray micrographic technique is presented as an aid in determining the spatial and orientation relationships between subgrains. 13 ref. (M26, M22g; W)

544-M.* Shape, Size and Growth of Some Intermetallic Compounds in Liquid Bismuth. P. J. Barton and G. W. Greenwood. *Institute of Metals, Journal*, v. 86, Aug. 1958, p. 504-509.

Shapes and sizes of particles of binary intermetallic compounds of U, Th, Ce, Zr, Mg, Ca, Sr, Ba, Te and Se with bismuth studied metallographically with respect to their mode of preparation, after isothermal treatment in liquid bismuth, under changes in temperature and on precipitation from solution. 16 ref. (M26q; Bi, 4-60)

545-M.* Preferred Orientation in Thorium. L. K. Jetter and C. J. McHargue. Paper from "The Metal Thorium", American Society for Metals, 1958, p. 161-185.

Deformation fiber texture of extruded Ames Th was found to be <111>. Recrystallization occurring during the fabricating process produced <001> or <114> fiber textures. 13 ref. (M26c, N5; Th)

546-M.* **Metallography of Thorium.** H. P. Roth. Paper from "The Metal Thorium", American Society for Metals, 1958, p. 282-295.

Mechanical polishing, electrolytic polishing and etching. Typical microstructures illustrate structural changes due to differences in composition and treatment of the metal. 11 ref. (M27, M20; Th)

N Transformations and Resulting Structures

498-N.* **The Non-Martensitic Diffusionless Transition in Manganese Arsenide at About 40° C.** Z. S. Basinski and W. B. Pearson. *Canadian Journal of Physics,* v. 36, Aug. 1958, p. 1017-1021.

It appears that plastic deformation of MnAs is impossible and so, instead of the change following the martensitic pattern, the strain energy of the transformation is minimized by a fragmentation of the crystal grains into pencil-like subgrains. 10 ref. (N6; Mn, As)

499-N. **Diffusion of Cerium and Zirconium in Molten Uranium.** T. Smith. *U. S. Atomic Energy Commission, NAA-SR-2628,* 1958, 26 p. (Available from U. S. Office of Technical Services, Washington 25, D. C.)

Coefficients measured over the range 1170 to 1480° C. An equation relates the diffusion coefficient and temperature. The diffusion coefficient for Ce at 1200° C. is 1.0×10^{-4} sq. cm. per sec. The solubility of Ce in molten U varies from 1 to 2% by weight over the range 1140 to 1345° C. Experimental errors involved in measuring diffusion coefficients at high temperatures. 6 ref. (N1b, 2-62; Ce, Zr, U)

500-N. **Progression of the Freezing Front and the Temperature Distribution in Ingots During Solidification.** J. W. Hlinka and V. Paschkis. *American Society for Metals, Transactions,* Preprint no. 97, 21 p.

Progression of freezing and temperature distribution in the liquid and solid regions of a slab-shaped ingot in terms of the mold-melt interface temperature. The problem is the freezing of a finite slab of pure metal or eutectic alloy contained in a "sufficient" mold; the range of variables included metals commonly used in industry, superheated and nonsuperheated, as well as preheated and subcooled molds, with the conclusion that the dimensionless interface temperature and dimensionless superheat define the progress of solidification and temperature distribution. 4 ref. (N12; 5-59)

501-N. (Czech.) **Crystallization of Metals.** Premysl Rys. *Slevarenstvi,* v. 4, no. 9, 1956, p. 263-267.

Fundamental thermodynamic conditions for spontaneous crystallization characterized by the appearance of supercritical nuclei (homogeneous nucleation). Influence of nonmetallic inclusions and of the walls of the mold on hardening; nature of the crystallization process at the walls; action of various types of nonmetallic inclusions. Examples of the action of inclusions on structure. Methods to obtain fine crystallization structure of metals and alloys. (N12, P12, 9-69)

502-N.* (French.) **Conditions of Regeneration of Single Crystals of Alpha Uranium Containing Traces of Impurities After a Period of Several Hours in the Beta Phase.** Gerard Donze and Rene Faivre. *Comptes Rendus,* v. 246, June 30, 1958, p. 3619-3621.

As previously determined for iron, it is found that regeneration of U monocrystals in alpha phase is due to conservation of crystal nuclei throughout alpha-beta-alpha transformation. Due to anisotropy of expansion of U, this phenomenon is shown very clearly in curves of thermodilatometric analysis. 6 ref. (N6p; U, 14-61)

503-N.* (French.) **Settlement and Diffusion of Hydrogen in Iron.** J. Plusquelloc, P. Azou and P. Bastien. *Comptes Rendus,* v. 246, June 30, 1958, p. 3628-3631.

It is established that H settles in (112) planes. Interruption of electrolysis provokes a greater absorption of H when charging is recommended. 7 ref. (N1c; Fe, *H*)

504-N. (Russian.) **Problem of the Anisotropy of the Speed of Growth of Crystals.** F. P. Tybalko. *Fizika Metallov i Metallovedenie,* v. 3, no. 1, 1956, p. 184-185.

A cylindrical bicrystal of Al was grown by passing a tube with molten Al (99.98%) through an electric furnace. The separation boundary of the crystals appears on the photograph as a saw-tooth line that parallels the generatrix of the cylinder. X-ray diffraction investigation shows that for one of the crystals the plane of the joint between the crystals, which makes an angle of 10° with the x axis, is the crystallographic plane (112). It is concluded that the rate of crystal growth has a different temperature dependence in different directions. (N12n; Al-a)

505-N. (Russian.) **Influence of Silver or Zinc Impurities in Aluminum on the Speed of Diffusion of Copper.** V. I. Arkharov and N. I. Noskova. *Fizika Metallov i Metallovedenie,* v. 2, no. 3, 1956, p. 472-476.

In a solid solution of Ag or Zn in Al, at high content of Ag or Zn (10 to 20%), the speed of diffusion of Cu is substantially greater than in pure Al. An explanation is offered for the previously established accelerating influence of small impurities (0.2%) of Ag (or Zn) on the speed of decomposition of supersaturated solid solution of Cu in Al. This can be caused by the positive internal adsorption of Ag (or Zn) taking place on the periphery of the produced particles of the phase that becomes precipitated from the very beginning stages of their formation, due to the particles turning out to be surrounded by zones of solid solution with increased concentration of Ag (or Zn). (N1e; Al-b, Ag, Zn, Cu)

506-N. (Russian.) **Cast Iron Sheet, Its Crystallization and Plastic Deformation in Cold and Hot States.** Ye. G. Nikolayenko and S. I. Vitenzov. *Novoye v Teorii i Praktike Liteynogo Proizvodstvo, Moskva-Leningrad Mashgiz,* 1956, p. 409-419.

Effect of conditions of primary and secondary crystallization and plastic deformation in cold and hot states on the structure and properties of cast iron sheets obtained by liquid rolling. (N12, N5, Q24; CI, 4-53)

507-N. (Russian.) **Processes of Carbide Formation in Isothermal Decomposition of Alloyed Austenite.** R. I. Entin. *Problemy Metallovedeniya i Fiziky Metallov,* v. 4, 1955, p. 239-250.

Structure of the carbide phase in Mo, Co-Mo and W steels investigated during the process of transformation at temperatures of the pearlite and intermediate regions, also after special binary treatments. Decomposition of the austenite in the pearlite temperature region in steels alloyed by carbide-forming elements is due to the formation of a carbide phase that is enriched with these elements, and consequently to a diffusion redistribution of the alloying elements. (N8r; AY, *Mo, Co, W*)

508-N. (Russian.) **Study of Auto-Diffusion of Alpha-Iron.** B. M. Golikov and V. T. Borisov. *Problemy Metallovedeniya i Fiziky Metallov,* v. 4, 1955, p. 528-542.

Modification of the absorption method, proposed for determination of small auto-diffusion factors, requires no preliminary determination of the absorption factor of the beta-radiation of the radioactive indicator. The processes taking place in the active layer and on the separating boundary layer-sample are taken into consideration. How to take the isotope composition of the compound into consideration is shown. Equation for the auto-diffusion of alpha-iron within the temperature interval from 650° to 850° is given. (N1d; Fe)

509-N. (Russian.) **Investigation of Diffusion Processes in Sintering Using Radioactive Isotopes.** L. M. Mirskiy, V. S. Rakovskiy and S. Z. Bokshteyn. *Poroshkovaya Metallurgiya, Yaroslavl',* 1956, p. 52-60.

Procedure developed made it possible to conclude that the ideas concerning the "hole" mechanism of diffusion are correct. The coefficients of diffusions determined for the alloys W-Ni, TiC-Mo, TiC-W and TiC-Cb coefficients make it possible to calculate the activation energy of W, Mo and Cb and consequently to determine the strength of the bond in the lattice. (N1e, 1-59; H15; W, Ti, Cb)

510-N. (Russian.) **Investigation of the Process of Crystallization of a Solid Solution.** L. P. Zaytseva. *Trudy Leningradskogo Politekhnicheskogo Instituta,* no. 180, 1955, p. 13-31.

Crystallization of a solid solution under actual cooling conditions investigated in 14 alloys of the Cu-Si, Cu-Si-Mn, Al-Zn and Sb-Bi systems. Ratio of liquid and solid phases during crystallization process was fixed for each given instant by hardening, after which a metallographic investigation was made of the structure of the alloys on microsections, and microhardness measured. Change of concentration of the separating initial dendrites and of the parent solution was investigated by ultraviolet color microscope and local spectrography. (N12p, Cu-b, Al-b, Sb-b)

511-N. (Russian.) **Investigation of Diffusion in Binary Alloys as a New Method of Physical-Chemical Analysis.** M. V. Neyman and A. Ya. Tsinyayev. *Zhurnal Neorganicheskoi Khimii,* v. 1, no. 6, 1956, p. 1257-1263.

(*)Articles Available Through Photocopy Service; See Coupon, p. 75.

The change in the coefficient of diffusion, D, the energy of activation, E, and the coefficient of the exponential D_0, as functions of the composition of the alloys were determined in Fe-Ni and Fe-Mo systems. In the Fe-Ni system, which in the temperature region from 900 to 1100° C., represents a continuous series of solid solutions of nickel in iron, D increases continuously, while E and log D_0 diminish continuously as functions of the alloy composition. In the Fe-Mo system, which contains the compound Fe_2Mo_3 in the temperature range 100 to 1200° C., D diminishes sharply and E and log D_0 increase sharply at the point corresponding to the chemical combination. (N1e; Fe, Ni, Mo)

512-N. (Russian.) **Investigation of the Tempering Processes in an Iron-Nitrogen System.** V. G. Permyakov. *Metallovedenie i Obrabotka Metallov,* no. 7, 1956, p. 2-9.

Structure of commercial iron, hardened after nitriding at 600 to 900° C., and its variations in tempering. Observation of the nitrided austenite and martensite obtained in the nitride layer during heating shows a far-reaching analogy between the tempering of hardened iron nitride and iron carbide alloys. Tempering begins with the decomposition of the martensite, on which is superimposed at 190 to 310° C. the decomposition of the residual austenite. As a result of one or the other a mixture of ferrite and of a nitride gamma-prime phase of different dispersions is formed. (N8a; Fe, N)

513-N.* **Conditioning Phenomenon in a High Chromium Steel.** S. C. Das Gupta. *Indian Institute of Metals, Transactions,* v. 9, 1955-1956, p. 207-217.

A 15% Cr, 0.7% C steel is studied under various conditions: without presence of initial martensite; in presence of initial martensite; plastically deformed specimens without any initial martensite. The degree of conditioning increases progressively with temperature of reheating above 300° C. However, in presence of initial martensite, an important change in the mode of formation of some of the martensite plates occurs above 450° C. 5 ref. (N8p; AY, *Cr*)

514-N.* **A Study of the Early Stages of Tempering in a 0.2% C, 9% Cr and 0.38% V Steel.** A. K. Seal. *Indian Institute of Metals, Transactions,* v. 11, June 1958, p. 73-88.

Mechanism of the early stages of tempering studied by long-time isothermal tempering at 170° C. for up to 1000 hr. Specimens were examined by hardness measurements, optical and electron microscopic studies, X-ray examinations of the carbide extracts and electron diffraction studies of the extraction replicas. It was found that the iron carbide formed at this temperature possessed an imperfect cementite structure. An attempt has been made to correlate the hardness and electron microstructural changes on tempering. 5 ref. (N8a; AY, *Cr, V*)

515-N.* (French.) **Determination of Coefficients of Diffusion and Study of the Kirkendall Effect on the Couple Uranium-Titanium.** Yves Adda and Jean Philibert. *Comptes Rendus,* v. 247, July 7, 1958, p. 80-83.

Concentration-penetration curves in U-Ti diffusion couple between 950 and 1075° C., coefficient of chemical diffusion determined as function of concentration. Quantitative study of Kirkendall effect; coefficients of intrinsic diffusion of U and Ti calculated. 4 ref. (N1e; U; Ti)

516-N.* (French.) **Influence of Tungsten on the Kinetic Parameters of the Formation of Proeutectoid Ferrite.** Karel Mazanec and Josef Cadek. *Revue de Metallurgie,* v. 55, June 1958, p. 501-512.

Tungsten decreases speed of nucleation of proeutectoid ferrite in temperature range 675-745° C. virtually independently of temperature. In low-temperature domains (below 650° C.), W causes decrease in rate of grain growth, while this rate remains practically constant at temperatures above 740° C. Role of time in speed of nucleation was also investigated. After period of incubation, speed of nucleation increases rapidly and, after reaching a maximum, decreases according to a hyperbolic curve. Speed of grain growth follows same hyperbolic pattern. Activation energy (33,600 cal. per mol.) proves that speed of growth is controlled by speed of diffusion of carbon in austenite. 21 ref. (N2, N8j; 2-60; AY, *W*)

517-N.* (French.) **Determination of Volume Self-Diffusion Constants of Iron in the Alpha Phase by Means of Radioactive Isotopes.** Claude Leymonie and Paul Lacombe. *Revue de Metallurgie,* v. 55, June 1958, p. 524-530.

A layer of Fe^{55} and Fe^{59} radioisotopes is deposited on surface of thin platelets of Armco iron. During a diffusion anneal under vacuum, activity of both sides of sample is measured periodically. A ratio exists between variation of measured activities and coefficient of diffusion. Experiments were conducted on polycrystalline specimens at temperatures above 850° C., on monocrystals at temperatures under 850° C. Under conditions described, variation of coefficient of diffusion D at absolute temperature T can be expressed by $D = 18 \exp. (-64000/RT)$. 8 ref. (N1d, 1-59; Fe)

518-N.* (Italian.) **Influence of Zirconium in Association With Manganese on Recrystallization and Mechanical Properties of Ac 11 Alloy Extrusions.** E. Di Russo and D. Gualandi. *Alluminio,* v. 27, July-Aug. 1958, p. 321-329.

Six Al alloys, three with and three without Zr additions, were studied. Recrystallization structure of extrusions is improved by addition of 0.15-0.20% Zr in presence of 0.3-0.4% Mn. This composition makes it possible to avoid stains, marbling and other undesirable effects caused by segregation of intermetallic compounds of Al-Mn and Al-Fe-Mn in anodized Ac 11 alloy when Mn content is 0.7%. Improvement in mechanical properties noted. 7 ref. (N5, Q-general, 2-60; Al-b, *Zr, Mn,* 4-58)

519-N. (Russian.) **Anisotropy of Crystal Growth Speed.** F. P. Rybalko. *Fizika Metallov i Metallovedenie,* v. 3, no. 1, 1956, p. 184-185.

It was found on X-ray study of a monocrystal of Al (99.98%), grown in a melt, that the crystal growth speed in different directions depends on temperature. (N3r; Al-a)

520-N. (Russian.) **Mechanism of Structural Transformations in Aging Alloys With a Nickel Base.** Yu. A. Bagaryatskiy and Yu. D. Tyapkin. *Kristallografiya,* v. 2, no. 3, 1957, p. 419-423.

X-ray structural method (oscillation X-ray photographs by "transmission" and by "reflection" in K_α-Cr, Fe, Ni, Cu, and Mo radiation) and X-ray photographs of diffusion scattering in K_α-Mo radiation have been used to study the aging of single crystals of alloys Ni-Al, Ni-Ti, Ni-Cr-Al, Ni-Cr-Ti, Ni-Al-Ti, including the Nimonic-80 type of alloy. The alloys become inhomogeneous even in the region of equilibrium solid solutions (1200-1300° C.). The dimensions of the irregularities observed in the hardened alloys depend on the content of Ti and Al and on the heating temperature. (N7a, M22g; Ni-b, 14-61)

521-N.* (English.) **Solution Anisotropy and Shape of Solution Body in Crystals.** Mikio Yamamoto. *Tohoku University, Science Reports of the Research Institutes,* v. 10, no. 3, June 1958, p. 183-200.

Derives from phenomenological considerations, taking into account crystal symmetry, the expressions for anisotropy of the solution rate and for the shape of the solution body in hexagonal, rhombohedral, tetragonal and cubic metal crystals. Data from theoretical formula for anisotropy of solution rate in accord with available experimental values. 13 ref. (N12, M26)

522-N.* (English.) **Diffusion of Silicon and Manganese in Liquid Iron. Pt. 1. Diffusion in Liquid Iron Saturated With Carbon.** Tunezo Saito and Kazuo Maruya. *Tohoku University, Science Reports of the Research Institutes,* v. 10, no. 3, June 1958, p. 259-268.

Diffusion coefficient determined for temperatures between 1300 and 1600° C. by the method of "semi-infinite medium". Diffusion coefficients of Si were 2.0 to 2.8 $\times 10^{-5}$ sq. cm. per sec. and activation energy of 8.2-k. cal. per g. atom. Diffusion coefficients of Mn were 3.0 to 4.1 $\times 10^{-5}$ sq. cm. per sec. and activation energy was 5.8 k.cal. per g. atom. 10 ref. (N1b; Si, Mn, Fe. 14-60)

523-N. (Russian.) **Decompositon of Solid Solution in Thin Laminae.** M. I. Zakharova and I. N. Soboleva. *Doklady Akademii Nauk SSSR,* v. 108, no. 5, 1956, p. 841-842.

Using X-ray diffraction and the variation of the lattice constant during tempering, an investigation was made of the dependence of the decomposition process on the dimensions of the specimens. Specimens 0.4, 0.02 and 0.004 mm. thick of a solid solution of Cu in Al were hardened and annealed for 1 hr. at temperatures from 180 to 320° C. After tempering at 180, 200, 220, 240, 300 and 320° C., the lattice constant of all the specimens was found to vary smoothly (i.e., homogeneous decomposition of the solid solution took place). After tempering at 260 and 280° C., the thinner specimens (0.02 and 0.004 mm.) exhibited regions of solid solution with a different degree of supersaturation. (N7, M26p, 1-60; Al, *Cu*)

524-N. (Russian.) **Recrystallization. Diagrams for Titanium and Titanium Alloys.** E. M. Savitzky, M. A. Tylkina and A. N. Turnaskaya. *Izvestiia Akademiia Nauk USSR, Otdelenie Tekhnicheskikh Nauk,* no. 7, 1956, p. 111-114.

Recrystallization diagrams of titanium iodide and titanium thermal magnesium (brand BTI-D) are plotted, which link together the size of metal grain with the deformation degree and with the subsequent annealing temperature or with the hot deformation temperature; recrystallization of hot rolled Ti calcium hydride also studied. (N5; Ti)

525-N. (Russian.) **Dependence of the Crystal Growth Shape on the Growth Speed.** V. I. Malkin. *Problemy Metallovedenya i Fiziky Metallov,* v. 4, 1955, p. 113-120.

Dependence of growth shape on growth speed of a salol crystal growing in a melt and the connection between growth speed and the structure in an ingot of Sn. The transition to an acicular growth shape is observed, when growth speed of the crystal increases. When undercooling is decreased, growth speed decreases also, and the growth of crystals of acicular shape is replaced by the growth of crystal of regular shape. The same transition to an acicular structure with the increase of growth speed was observed also in an ingot of Sn. (N12; Sn)

526-N. (Russian.) **Effect of Elements That Form Difficultly Soluble Carbides on the Decomposition of Austenite.** L. I. Kogan and P. I. Entin. *Problemy Metallovedenya i Fiziky Metallov,* v. 4, 1955, p. 251-286.

When hardening from ordinary heat treating temperatures (900 to 1000° C.), the presence of such strongly carbide-forming elements as Ti, V, Zr, Cb and Ta reduces the hardenability of carbon steel, owing to the formation of quite stable carbides by these elements. A partial transformation of these carbides into austenite when heating to 900 to 1000° C. can be accomplished by alloying the steel with manganese (1.5 to 2.5%). In this case, addition of Ti to Mn steel increases considerably the stability of the austenite in the pearlite and intermediate regions. (N8r, 2-60; AY, *Mn, Ti*)

527-N. (Russian.) **Radioactive Tracer Investigation of the Distribution of Chromium and Tungsten During the Process of Austenite Decay.** S. V. Tsivinskiy, L. I. Kogan and R. I. Entin. *Problemy Metallovedenya i Fiziky Metallov,* v. 4, 1955, p. 277-295.

Radioactive isotopes used to determine the contents of Cr and W in the carbide phase in steels with 1.18% C and 2.42% Cr and with 1.02% C and 0.78% W, respectively, in the process of transformation of austenite at the temperatures of the pearlite and intermediate regions. In the process of decomposition in the pearlite region, contents of the alloying elements in the carbides exceed their contents in steel by a factor of 3 to 5 times. Results prove that decomposition of the austenite in the pearlite region is connected with the need for diffusion redistribution of tungsten. (N8h, 2-60, 1-59; AY, *Cr, W*)

528-N. (Russian.) **Influence of Alloying Elements on the Eutectoid Transformation in Steel.** N. T. Gudtsov and I. Chadek. *Sbornik Moskovskogo Instituta Stali,* v. 36, 1957, p. 13-32.

Investigation of carbide phase of the products of isothermal eutectoid transformation, of carbide phase formed during prolonged annealing of these products at the same temperature and of carbide phase of the products of tempering of martensite. Role of kinetic factors in eutectoid transformation; formation of the cementite is not a primary factor in the eutectoid reaction even when the latter is one of the stable carbide phases of the particular steel. (N8r, 2-60; AY)

529-N. (Russian.) **Relaxation and Recrystallization of Single-Phase and Aging Alloys With a Nickel Base.** S. S. Gorelik, Yu. V. Gracheva, N. O. Borneyev, I. G. Skugarev and E. N. Spektor. *Sbornik Moskovskogo Instituta Stali,* v. 36, 1957, p. 103-130.

Influence of 1 to 20% Cr on recrystallization temperature of Nichrome. Compared with Ni, Nichrome has a considerably higher recrystallization temperature. Introducing into Nichrome alternately B, Mo and W, while retaining the single-phase nature of the alloy, has little effect on the temperature of the start of recrystallization but shifts the temperature of the end of recrystallization upward. Introducing elements that cause aging leads to a considerable increase in recrystallization temperature, with the strongest effect being exhibited by Al, Ti, Al + Ti, Al + Ti + Mo, Al + Ti + Mo + W. (N5, 2-60; Ni-b)

530-N. (Russian.) **Effect of Tungsten on the Kinetic Parameters of the Formation of Ferrite in Isothermal Transformation of Austenite.** I. Chadek and K. Mazanets. *Sbornik Moskovskogo Instituta Stali,* v. 36, 1957, p. 147-159.

In the range from 675 to 740° C., W reduces the speed of formation of nuclei, and the rate of increase diminishes noticeably with increasing W, particularly at low temperatures (below 650° C.), and hardly diminishes at higher temperatures (about 745° C.). At greater supercooling, rate of growth is determined by diffusion of carbon in the austenite, and at smaller supercooling, by formation of double nuclei. Rate of formation of nuclei diminishes at small degrees of supercoolings, due to the influence of W on surface tension at the boundary of the gamma grain. (N8g, 2-60; AY, *W*)

531-N. (Russian.) **Theory of the Growth of Centers of a New Phase in Isothermal Decomposition of Austenite.** B. Ya. Lyubov. *Trudy Nauchno-Tekhnicheskogo Obshchestva, Chernoy Metallurgii,* v. 3, 1955, p. 39-44.

Theoretical analysis of the growth of centers of a new phase in the isothermal decomposition of supercooled austenite. The new phase (ferrite, cementite or pearlite) differs from the initial one (austenite) in its structure as well as in its composition. Consequently, the redistribution of the dissolved matter combines in the phase transition with the transition of the solvent from one structural form to another. The kinetics of the growth process of the center, by which the particular components of its simple processes cause a minimum rate of displacement of the boundary between the phases, are determined. (N8g)

532-N.* **The Preparation and Properties of Gallium Arsenide Single Crystals.** J. M. Whelan and G. H. Wheatley. *Physics and Chemistry of Solids, Journal,* v. 6, Aug. 1958, p. 169-172.

Preparation of gallium arsenide single crystals by the floating-zone method. These crystals have resistivities in the range 10^{-2} to 10^{-6} omega-cm. Hall coefficient and conductivity were measured for five n-type samples in the temperature range 50-900° K. An impurity level 0.54 ± 0.05 eV below the conduction band is believed to be responsible for the high-resistivity sections of the crystals. 12 ref. (N3r, P15, Ga, As, 14-61)

533-N.* **Diffusion, Solubility and Electrical Behavior of Copper in Gallium Arsenide.** C. S. Fuller and J. M. Whelan. *Physics and Chemistry of Solids, Journal,* v. 6, Aug. 1958, p. 173-177.

Copper diffuses into GaAs single crystals at rates comparable to those found for Cu in Si and Ge. As with Ge, the diffusion appears to follow the dissociative mechanism. Autoradiographic evidence for this. The diffusion process requires both interstitial and substitutional roles for Cu. Solubility of Cu in single crystals of GaAs determined from 700 to 1160° C. by means of Cu^{64}. 10 ref. (N1, P15, Cu, Ga, As)

534-N.* **Thermodynamics of Ordering Alloys. Pt. 3. Energies of Transformation of the $Au_{½}Cu_{½}$ Phases.** R. A. Oriani and W. K. Murphy. *Physics and Chemistry of Solids, Journal,* v. 6, Aug. 1958, p. 277-279.

Energy differences among the two superlattices and the disordered solid solution at the composition $Au_{½}Cu_{½}$ have been derived from calorimetric measurements of the heats of formation of the three phases. It is shown that neither of these transitions is understood in terms of quasi-chemical theory. 10 ref. (N10b, P12q; Au, Cu)

535-N. (Czech.) **Setup for Growing Single Crystals of Metals.** Bohdan Sestak. *Ceskoslovensky Casopis pro Fysiku,* v. 7, no. 2, 1957, p. 202-208.

Crystals were grown in an atmosphere of argon at atmospheric pressure. Protective atmospheres are purified of oxygen and dried in a special apparatus during growth of the single crystals. Procedure of growing single crystals of Cu and Ni is by the Bridgeman method. Cu crystals of 12 mm. diameter and 99.95% purity were grown in a graphite crucible at velocities of 37.2 to 76 mm. per hr., and Ni crystals 99.85% pure and 15 mm. in diameter were grown in a crucible made of pure sintered Al at a crucible displacement rate of 9.1 to 25 mm. per hr. (N3r; Cu, Ni)

536-N.* (German.) **Essential Features of the Discontinuous Precipitation in Zinc-Copper and Copper-Silver Alloys.** W. Gruhl and H. Kramer. *Metal,* v. 12, Aug. 1958, p. 707-712.

(*)Articles Available Through Photocopy Service; See Coupon, p. 75.

In discontinuous precipitation the grain boundary moves into the adjacent crystal. By tests with an alloy of Zn and electrolytic Cu, process of discontinuous precipitation and correlation between discontinuous and continuous precipitation is shown. Displacement of grain boundary explained by liberated energy resulting from the boundary itself as well as from the solid solution. 15 ref. (N7; Zn, Cu, Ag)

537-N.* (Japanese.) **Precipitation of Alpha Phase in Magnesium-Lithium Beta Phase Alloy by Preferential Oxidation of Lithium.** S. Morozuni, S. Matsuo and T. Takeuchi. *Nagoya Industrial Experimental Station, Report,* v. 7, July 1958, p. 504-510.

Specimens are Mg alloy with 11% Li beta phase, cold pressed, cut, annealed at 350° C. and then heated at 500° C. in silica tube under 10^{-2} mm. Hg. Fine precipitates are found along the grain boundary of the matrix, which was a single-phase solid solution and, after a few hours, grow with distinct orientation. Debye-Scherrer X-ray diffraction patterns show that closed-packed hexagonal phase has appeared in body-centered cubic lattice. The orientation of the precipitates is analyzed by stereographic projection diagram which is drawn according to the knowledge from Laue spots. The new alpha-phase could be platelets parallel to {112} plane of the matrix. (N7; Mg, *Li*)

538-N. (Russian.) **Aging of the Al-Cu Alloy.** N. N. Buynov. *Fizika Metallov i Metallovedenie,* v. 1, no. 2, 1955, p. 339-348.

The Guinier-Preston zones 1 are present in the alloy immediately after hardening. During the process of low-temperature aging, the zones increase and become enriched with Cu, and the Guinier-Preston zones 1 become Guinier-Preston zones 2. The basic feature of artificial aging during the stage of vigorous strengthening of the alloy is the enrichment of the existing zones by Cu and their allotropic transformation into particles of the theta-prime phase.
(N7a, N6p; Al-Cu)

539-N. (Russian.) **X-Ray Diffraction and Electron-Microscope Investigation of Aging of an Al-Zn Alloy.** N. N. Buynov and L. I. Podrezov. *Fizika Metallov i Metallovedenie,* v. 1, no. 2, 1955, p. 349-358.

In the initial stage of aging, the Guinier-Preston zones hardly differ in structure from that of the matrix, are coherently connected with it, and are little saturated with the Zn atoms. Ths first stage of aging is significant in the enrichment of the zones with Zn. It leads to a distortion of the structure of the zones themselves and of the adjacent solid-solution regions, as evidenced by the asymmetry of the anomalous effects (diffused and linear) of the characteristic radiation. When the Zn concentration in the zones reaches almost 100%, the cubic lattice turns into the hexagonal lattice of Zn (second aging stage—separation).
(N7a, M21e, M22g; Al-a, *Zn*)

540-N. On the Growth and Properties of Electrolytic Whiskers. P. B. Price, D. A. Vermilyea and M. B. Webb. *Acta Metallurgica,* v. 6, Aug. 1958, p. 524-531.

Under certain conditions metal electrodeposited from solutions containing certain specific impurities takes the form of whiskers varying in diameter from about one to several microns and as long as several millimeters. A theory is advanced to account for the growth of electrolytic whiskers and is compared with experimental observations. Data on strength, electrical resistivity and structure of whiskers. 11 ref. (N3r, N12d)

541-N. Grain Growth on α-Brasses. P. Feltham and G. J. Copley. *Acta Metallurgica,* v. 6, Aug. 1958, p. 539-542.

13 ref. (N3; Cu-n)

542-N.* Formation of Ferrite and Pearlite in Cast Iron. G. Ohira and K. Ikawa. *Modern Castings,* v. 34, Oct. 1958, p. 60-66.

Formation of ferrite and pearlite studied in iron-carbon, iron-carbon-silicon alloys and charcoal pig iron. At the eutectoid temperature pearlite was nucleated by cementite which had precipitated on cooling after solidification; ferrite crystallized out on precipitated graphite. Pearlite formation was promoted when the Fe contained P or Sn. Ferrite formation was promoted by Mn. 5 ref. (N8h, N12; CI)

543-N.* Diffusion of Cadmium Into Single Crystals of Copper. Tokutaro Hirone, Nobuhiko Kunitomi, Masanobu Sakamoto and Hideo Yamaki. *Physical Society of Japan, Journal,* v. 13, Aug. 1958, p. 838-840.

Diffusivity measured in the range from 725 to 950° C. using radioactive isotope Cd^{115} as a tracer. Values obtained are compared with the corresponding values for the diffusion of Zn into Cu to investigate the effect of the difference in atomic radii.
(N1e, 1-59; Cu, *Cd,* 14-61)

544-N. Investigation of Germanium-Silicon Alloys. C. C. Wang, Sylvania Electric Products, Inc. *U. S. Office of Technical Services,* PB 131422, Feb. 1955, 50 p. $1.25.

Experimental methods for preparing homogeneous Ge-Si alloys in polycrystalline form for all the compositions and in single-crystal form for the low-Si alloys. Isothermal solidification technique used in preparing the alloys. From the standpoint of devices and ease of preparation, the most useful alloys are in the range between 0 to 15 at. % Si. (N12, N3r; Ge-b, *Si*)

545-N.* The Diffusion of Hydrogen in Steel at Temperatures of −78 to 200° C. J. D. Hobson. *Iron and Steel Institute, Journal,* v. 189, Aug. 1958, p. 315-321.

Using cylindrical specimens cut from large forgings, it is shown that diffusion of hydrogen in carbon and alloy steels does not follow predictions of accepted exponential equation at temperatures below 150° C. Diffusion constant at a given temperature varies with steel composition but square relating rate of evolution and specimen diameter is followed approximately. Results of experiments on large castings in agreement with laboratory measurements. 13 ref. (N1, 2-61; ST, *H*)

546-N.* Behavior of Nitrogen in 3% Silicon Iron. R. E. Fryxell, N. Galitzine and F. S. Gardner. *Iron and Steel Institute, Journal,* v. 189, Aug. 1958, p. 327-332.

Vacuum fusion method, hydrochloric acid evolution method and chemical separation followed by X-ray identification of inclusions were utilized in studying influence of quenching temperature, time of heat treatment and steel composition on reactions of nitrogen in 3% silicon iron. Results interpreted in terms of solution precipitation equilibrium of silicon nitride (Si_3N_4). Re-evaluation of chemical analysis methods. 21 ref. (N7, S11, 2-64; Fe, *Si*)

547-N.* (German.) **X-Ray Observations on Age Hardening Properties of Aluminum - Magnesium - Zinc Alloy.** Hermann Schmalzried and Volkmar Gerold. *Zeitschrift für Metallkunde,* v. 49, June 1958, p. 291-301.

Phases occurring during the age hardening process in an alloy with 6.5% Mg and 3.5% Zn. In the cold hardening phase at 135° C. a separation of Mg and Zn atoms takes place accumulating alternately in (001) planes of the crystals. The Mg atoms cause lattice distortion limiting the cluster diameter to about 25 Å. Above 80° C. the semi-stable intermediate phase $MgZn_2$ was observed in two orientations. Above 190° C. an additional stable ternary phase T ($Al_2Mg_3Zn_3$) appears. 29 ref. (N7a; Al-b, *Mg, Zn*)

548-N.* (Russian.) **Effect of Nickel Additions on Phase Transformations in Al-Cu Alloys During Long-Time High-Temperature Anneals.** A. Z. Zhmudskii and P. A. Maksimyuk. *Metallovedenie i Obrabotka Metallov,* Aug. 1958, p. 34-37. (Henry Brutcher, Altadena, Calif., Translation no. 4319.)

Investigation conducted by X-ray analysis and microhardness tests. Introduction of Ni retards the diffusion process in Al-Cu-Ni alloys at elevated temperatures. This slows down the aging process and grain growth thereby increasing the heat resistance of Al alloys. Maximum amount of Ni needed to inhibit decomposition is 1%. Addition of 0.5% Ni in Al-Cu-Ni alloys impedes grain growth during heat treatment. (N3, N1, N7a, 2-60, Al-b, *Ni*)

549-N.* (Russian.) **Grain Refinement on High-Temperature Heating.** Ya. R. Rauzin. *Metallovedenie i Obrabotka Metallov,* Aug. 1958, p. 14-17. (Henry Brutcher, Altadena, Calif., Translation no. 4314.)

Study of grain structure of metals when heated near melting point. Heating of 99.5% pure Al wire shows a continual grain growth. At 400° C. the average grain size is 0.12 mm.; at 600° C. it increases to 0.81 mm. As result of very slow increase of heat (5° per hr.) the average grain size slightly increases to 0.14 mm. at 400° C. and to 0.92 mm. at 600° C. Conclusions: there is no relation between grain refinement and phase transformation. Very slow heating, even to very high temperatures, does not lead to grain refinement. Quick heating at high temperatures results in localized plastic deformation and recrystallization resulting in considerable grain refinement. 10 ref.
(N3, N5; Al-a)

550-N.* Preparation of FeO, NiO and CoO Crystals by Halide Decomposition. R. E. Cech and E. I. Alessandrini. *American Society for Metals, Transactions,* v. 51, Preprint no. 82, 1958, 8 p.

New method for producing crystals of FeO, NiO and CoO. Oxide crystals are produced by elevated-temperature decomposition of metal halide in an atmosphere which has hydrogen and water vapor in the proper ratio to be in equilibrium with the monoxide phase of the metal. The metal halide decomposition occurs on an MgO crystal sur-

face and deposits oxide in an epitaxially oriented film. Oxide crystal films 500 microns thick have been produced. 6 ref.
(N3r; Fe, Ni, Co, 14-68)

551-N.* Diffusion Layer Formation in the Ternary System Aluminum-Magnesium-Zinc. J. B. Clark and F. N. Rhines. *American Society for Metals, Transactions,* v. 51, Preprint no. 85, 1958, 19 p.

Identity, order and structure of ternary diffusion layers studied in couples composed of Al and a series of Mg-Zn alloys, using metallographic and X-ray diffraction methods. The sequence of layers always corresponds to consecutive regions in the appropriate ternary isotherm of the phase diagram; the composition path represented by successive compositions in the diffusion couple deviates away from that component which diffuses the most rapidly. 10 ref. (N1e, M24c; Al, Mg, Zn)

552-N.* The Mechanism of the Allotropic Transformation in High Purity Iron. Erwin Eichen and J. W. Spretnak. *American Society for Metals, Transactions,* v. 51, Preprint no. 89, 1958, 16 p.

Studied using a thermionic emission microscope. Criterion for discerning the difference between a nucleation and growth mechanism and a shear mechanism. Mechanism of the allotropic transformation in high-purity Fe just below the A_{e3} temperature is a shear mechanism. As the degree of undercooling increased, the average length of the individual shears increased, and the average rest periods between shears decreased. 8 ref. (N6p; Fe-a)

553-N.* The Effect of Stress on the Eutectoid Decomposition of Titanium-Chromium Alloys. A. W. Goldenstein, A. G. Metcalfe and W. Rostoker. *American Society for Metals, Transactions,* v. 51, Preprint no. 92, 1958, 18 p.

Three Ti-Cr alloys have been forged in the beta range to give six systems with controlled amounts of each phase. The isothermal transformation at 400, 500 and 600° C. of each of these systems was followed by resistivity, X-ray diffraction, elastic modulus measurements and metallography. The transformation study was repeated under a stress which produced creep in 1000 hr. An acceleration of 4 to 7 times in the rate of transformation occurred under the action of this stress. Complete tensile test data were obtained at all stages of the transformation and plotted on the T-T-T diagrams. 12 ref. (N7c; Ti, Cr)

554-N.* Austenite Transformation and Incubation in an Alloy Steel of Eutectoid Carbon Content. R. A. Grange, P. T. Kilhefner and T. P. Bittner. *American Society for Metals, Transactions,* v. 51, Preprint no. 93, 1958, 19 p.

Transformation of austenite as it occurs isothermally and on continuous cooling was studied in a Ni-Cr-Mo steel whose carbon content was such that neither pro-eutectoid ferrite nor pro-eutectoid carbide formed. Comparison of the resulting T-T-T diagrams reveals that the methods proposed for correlating the two are unsatisfactory for this steel. This is because holding metastable austenite in certain temperature ranges, whether accomplished by isothermal treatment or by comparatively slow continuous cooling retards subsequent transformation at a lower temperature. 13 ref.
(N8; AY, *Ni, Cr, Mo*)

555-N.* A Study of the Solidification Process in Grey and White Cast Irons. A. G. Fuller and I. C. H. Hughes. *British Cast Iron Research Association, Journal,* v. 7, Aug. 1958, p. 288-298.

Using the quenching technique and thermal analysis, the mode of eutectic solidification of 2-in. bar castings is studied for a white iron and a hyper-eutectic flake graphite iron. The white iron eutectic solidification by the progressive growth of columnar crystals, from the edge to the center of the casting, to form a continuously thickening, sharply defined shell of solid, while the center of the casting remained completely liquid. The hyper-eutectic gray iron eutectic solidified in a similar manner to that of a hypo-eutectic gray iron. 5 ref.
(N12q; CI)

556-N.* Recrystallization of Thorium. E. J. Boyle. Paper from "The Metal Thorium", American Society for Metals, 1958, p. 217-224.

Pure Th, prepared by decomposition of the iodide, recrystallizes in the range from 500 to 700° C. after 20 to 80% reduction by cold rolling. Ames Th, prepared by calcium reduction of the fluoride, recrystallizes in the range from 520 to 700° C. after 20 to 80% reduction by cold rolling. Carbon, which is the principal contaminant in Ames Th, does not appear to have a significant effect on the recrystallization temperature range. (N5; Th)

557-N. Precipitation of Cu in Ge. Pt. 2. Supersaturation Effects. A. G. Tweet. *Physical Review,* v. 111, July 1, 1958, p. 57-66.

Evidence for the nucleation of Cu precipitates upon a single type of nucleation site in a supersaturated solid solution of Cu in essentially dislocation-free Ge. (N7; Cu, Ge)

558-N. Growth and Properties of "Whiskers". S. S. Brenner. *Science,* v. 128, Sept. 12, 1958, p. 569-575.

Further research is needed to show why crystal filaments are many times as strong as large crystals. 69 ref. (N3r)

Physical Properties

532-P.* How Radiation Damages Metals. M. J. Makin. *Atomics and Nuclear Energy,* v. 9, Aug. 1958, p. 260-263.

Effects of high energy radiation on metals from theoretical and practical viewpoints. Four particle-metal interactions described. 23 ref.
(P-general, Q-general, 2-67)

533-P.* Note on the Rate of Evolution of Hydrogen at a Magnesium Anode. J. H. Greenblatt. *Canadian Journal of Chemistry,* v. 36, Aug. 1958, p. 1138-1140.

Mechanism of anodic dissolution of Mg reviewed. Temperature dependence of rate of hydrogen evolution at Mg anodes during electrolysis. 10 ref. (P15; Mg, *H*)

534-P.* Electrical Conductivity of Manganese Arsenide and Antimonide. Gaston Fischer and W. B. Pearson. *Canadian Journal of Physics,* v. 36, Aug. 1958, p. 1010-1016.

Conductivity determined for MnAs and MnSb from 40 to 200° C.; ferromagnetic, paramagnetic states studied. 11 ref. (P15g; Mn, As, Sb)

535-P.* Neutron Bombardment of Reactor Metals. Robert S. Barnes. *Times Review of Industry,* v. 12, Aug. 1958, p. 20-21, 24.

Effect of bombardment on reactor construction materials and fuel elements; change in properties, dimensions, gas evolution. (P18, T11)

536-P. Influence of Elastic Stresses on the Magnetic Properties of the Alloy Vicalloy. Ia. S. Shur, M. G. Luzninskaia and L. A. Shubina. *Physics of Metals and Metallography,* v. 4, no. 1, 1957, p. 40-44. (Translation by Pergamon Institute.)

Influence of unilateral elastic extension and elastic torsion on the magnetic properties of the high-coercivity alloy Vicalloy (12% V, 52% Co, residue Fe). Samples were investigated in the form of wires. Extension leads to an increase in coercive force of several times and likewise to a growth of the remanent induction. The increase of coercive force obtained is explained by an increase in the anisotropy of single-domain formations on account of the growth of the anisotropic stress.
(P16, Q21; Co, Fe, V, SGA-n)

537-P. Thermomechanical Treatment of Vicalloy. Ia. S. Shur, M. G. Luzhinskaia and L. A. Shubina. *Physics of Metals and Metallography,* v. 4, no. 1, p. 45-52. (Translation by Pergamon Institute.)

Alloy containing 52% Co, 12% V, balance Fe was investigated in the form of cold drawn wires. Thermomechanical treatment consisted in superimposing unilateral tensile stress on the samples at time of annealing, and as a result high coercive force was obtained. This treatment can appreciably alter the magnetic properties, and under certain conditions coercive force can be increased by 25% and maximum magnetic energy by 40-50%. 7 ref.
(P16, 2-64; Fe, Co, V)

538-P. The Dependence of the Magnetic Properties of Metallo-Ceramic Permanent Magnets on Porosity. A. B. Alt'man. *Physics of Metals and Metallography,* v. 4, no. 1, 1957, p. 65-68. (Translation by Pergamon Institute.)

Influence of the porosity of metallo-ceramic permanent magnets made from the alloys Alni, Alnico, Magnico and Cunico on their magnetic properties. Some empirical formulas are advanced, expressing the dependence of the magnitude of the maximum magnetic energy and residual induction of the magnets on the concentration of pores in them. 4 ref.
(P16, P10m; SGA-n, 6-70)

539-P. Influence of Surface Treatments on the Chemical Behavior of Metals. T. P. Hoar. Paper from "Effect of Surface on the Behaviour of Metals", Philosophical Library, 1958, p. 29-40.

Chemical reaction of a metal surface almost always involves the loss of cations and electrons from the

(*)Articles Available Through Photocopy Service; See Coupon, p. 75.

metal. Reaction is accelerated by anything that assists the loss of either cations or electrons or both, and retarded or stopped by anything that interferes with such loss. Cation egress is assisted by mechanical removal of any oxide film and by production of dissaray in the metal surface by, for example, abrasion, or other forms of cold work. Cation egress can be retarded by surface treatments giving films that are impervious to cation except at high field strengths. 18 ref. (P13)

540-P.* (French.) **Change in the Specific Mass of Uranium After Cold Working and During Annealing.** Jean-Pierre Mustelier. *Comptes Rendus,* v. 246, June 16, 1958, p. 3347-3350.

Loss of density was noted after cold working. In cold worked specimen subjected to a series of 1-hr. anneals at increasing temperatures, abrupt increase in density, corresponding to recrystallization, occurred at about 450° C. Final anneal of one month at 630° gave specimen almost same density as before cold working. Variations in density are attributed to formation and disappearance of defects (vacancies, interstitial atoms, dislocations) in crystal lattice.
(P10a, 2-64, 3-68, M26s; U)

541-P.* (French.) **Secondary Electronic Emission of Metals Bombarded by Positive Ions.** Georges Slodzian. *Comptes Rendus,* v. 246, June 30, 1958, p. 3631-3634.

Table of coefficients of secondary electronic emission of metals under bombardment by ions of air and argon. Measurements show that these coefficients can vary considerably with the nature and condition of specimen. Bombarding device prevents contamination of target.
(P15k, 1-53)

542-P.* (French.) **Applications of Cold in Metallurgy.** G. de Smet. *Pratique des Industries Mecaniques,* v. 44, June 1958, p. 141-153.

Behavior of metals at low temperature; cooling fluids and equipment; shrink fitting; structural transformations in cold hardened steels; spontaneous hardening; structural and dimensional stabilization of some metals at subzero temperatures; low-temperature ductility tests. 38 ref.
(P-general, Q-general, 2-63, J26q)

543-P. (Russian.) **New Methods for Determining the Heat of Melting and Transformation of Metals.** A. I. Lazarev. *Issledovaniya v Oblasti Teplovykh Izmereniy. Moskva-Leningrad, Mashgiz,* 1956, p. 21-31.

Transformation heat measured by placing two identical hollow specimens, one of which contains the heater, in the chamber of a metallic block calorimeter, the temperature of which varies linearly with time. To measure the melting temperature, one of the specimens, made of metal having a known specific heat, is made solid. The second specimen is made hollow and the metal having the unknown melting temperature is placed in its cavity. The heat of eutectoid transformation in steel with 0.83% carbon (14.53 cal. per g.) and the melting heat of lead (6.0 cal. per g.) were measured.
(P12q, 1-54; CN, Pb)

544-P. (Lithuanian.) **Some Photoelectric Properties of Antimony Trisulphide (Sb_2S_3).** P. P. Brazdzhyunas and M. Mikal'kevichus. *Mokslo Darbai. Vilniaus Valstybinis Universitetas Matemortiokos Fizikos ir Chemijos Mokslu Serijos,* no. 5, 1956, p. 57-68.

A layer of Sb_2S_3 containing an excess of S was obtained by the sublimation of Sb_2S_3 in vacuum. The curve giving the dependence of the photosensitivity on the amount of excess S shows a sharp maximum. The spectral characteristic of the photosensitivity was investigated. (P17; Sb)

545-P. (Russian.) **Optical Properties of Intermetallic Compounds. Zinc-Antimony Compound.** K. D. Sinel'nikov, T. N. Shklyarewskiy and Y. A. Lupashko. *Uchenye Zapiski Khar'kovskogo Universiteta,* v. 64, 1955, p. 141-144.

Determination of specific conductivity, transparency and absorption coefficient of ZnSb films from 350-1500 millimicrons. The optical density in the region of 400 to 1000 millimicrons is independent of the temperature in the range from 20 to 100° C. (P17; Zn, Sb)

546-P. (Ukrainian.) **Viscosity and Structure of Liquid Solutions of Zinc, Cadmium, Tin, Bismuth and Lead in Mercury.** A. Z. Golik and N. A. Ryndich. *Ukrains' kii Fizichnii Zhurnal,* v. 1, no. 2, 1956, p. 170-182.

The viscosity obeys an exponential law in the temperature range under investigation. The energy of activation of viscous flow is a linear function of the concentration. The density diminishes linearly with increasing temperature. (P10f, P10a; Zn, Cd, Sn, Bi, Pb, Hg, 14-60)

547-P.* (French.) **Variations in Length and Density During Charging of Zirconium in Hydrogen.** L. Espagno, P. Azou and P. Bastien. *Comptes Rendus,* v. 247, July 7, 1958, p. 83-86.

Charging in H provokes linear variation in length and density of Zr. These variations are sufficiently pronounced to be easily used for determination of gas content.
(P10a, P10d; Zr, *H*)

548-P.* (French.) **Apparatus for Measuring Resistivity at Ambient and High Temperatures. First Applications to the Study of Uranium-Molybdenum Alloys.** J. Bellot, N. Sacovy and J. M. Henry. *Metaux, Corrosion-Industries,* v. 33, June 1958, p. 243-252.

Two apparatuses described, one for measuring resistivity at room temperature, one for measurements up to 1000° C. Transformation kinetics of some U-Mo alloys at room temperature; interpretation of mechanism of return to equilibrium from supersaturated gamma phase. 11 ref. (P15g, N9n, 1-53; U, Mo)

549-P.* (French.) **Some Physical Properties of Gallium Monocrystals Near the Melting Point.** Marc Ernv. *Metaux. Corrosion-Industries,* v. 33, June 1958, p. 253-269.

Preparation of monocrystals; X-ray study of crystal structure. Study of symmetry from 20° C. to melting point (29.75° C.) by means of Laue back reflection patterns showed that Ga crystals belong to orthorhombic system in range from 20 to over 29.5° C. above which point trihedral formed by crystal axes changes orientation. This phenomenon is attributed to pronounced anisotropic expansion or contraction of crystal. Study of anisotropy of electrical resistivity at 20° revealed that speed of propagation of elastic waves varies with direction of propagation; similarly, resistivity varies with direction of current with respect to crystal axes. (To be continued.)
(P15g, M26, 2-62; Ga)

550-P. (Russian.) **Thermal and Electric Properties of Alloys of Copper.** V. Ye. Mikryukov. *Vestnik Moskovskogo Universiteta Seriya Matematiki, Mekhaniky, Astronomii Fiziki Khimii,* no. 2, 1956, p. 53-70.

Investigation within a range from room temperature to 600° of electric conductivity and thermal conductivity of Cu to which small amounts of Cr, Ni, Zr, Al, Be and Ta were added. The alloys were investigated in two states; normalized and tempered after quenching. (P1Ih, P15g, 2-60, 2-64; Cu-b)

551-P.* (English.) **The Wiedemann Effect of the Binary System of Iron-Aluminum Alloys at High Temperatures.** Yuki Shirakawa, Toru Ohara and Takeshi Abe. *Tohoku University, Science Reports of the Research Institutes,* v. 10, no. 3, June 1958, p. 212-218.

Wiedemann effect at 70 to 700° C. of annealed specimens of Fe-Al alloys containing up to 17% Al. Relation between torsion of specimen and circular field current, longitudinal field strength, temperature and Al content. 4 ref. (P16; Fe-b, Al)

552-P.* (English.) **Theory of the Wiedemann Effect.** Mikio Yamamoto. *Tohoku University, Science Reports of the Research Institutes,* v. 10, no. 3, June 1958, p. 219-239.

Derivation of a general expression for the Wiedemann effect or the torsion angle in a cylindrical rod of ferromagnetic substance fixed at its one end and magnetized by a longitudinal magnetic field parallel to and by a circular field around its rod axis. 16 ref. (P16)

553-P. (Russian.) **Radioactive Isotope Study of the Behavior of Antimony in Electrolytic Copper Refining.** S. G. Filimonova. *Nauchno-Teknicheskii Informatsionnyi Byuleten' Leningradskogo Politekhnicheskogo Instituta,* no. 3, 1957, p. 19-31.

Influence of various factors on the inclusion of Sb in electrolytic Cu in the process of refining, using the radioactive isotope Sb^{124}. Sb passes into Cu as the result of discharge of Sb^{5+} ions, which starts at potentials of 0.23 to 0.24 v. The more positive potential of discharge of Sb ions in the process of Cu refining indicates the depolarization at a simultaneous discharge of Sb and Cu ions.
(P15m, C23p, 1-59; Cu, *Sb*)

554-P. (Russian.) **Cathode Polarization on Alloy Formation. Study of Co-Ni Alloys.** V. M. Kochegarov, A. L. Rotinyan and N. P. Fedot'yev. *Trudy Leningradskogo Instituta Imeni Lensoveta,* v. 40, 1957, p. 112-123.

Cathode polarization on simultaneous and separate electrolytic precipitation of Co and Ni studied at various temperatures and various electrolyte concentrations. In case of electrolytic precipitation from a mixed solution, the partial cathode polarization curves for Co precipitation shift to the positive side more sharply than in case of Ni precipitation. Depolarization is caused by formation of a solid solution and super-polarization is caused by difficulties in formation of an overall crystalline lattice.
(P15, N12d, C23; Co, Ni)

555-P. (Russian.) **Internal Stresses in Electrolytic Precipitations of Copper.** A. A. Khonikevich and N. P. Fedot'yev. *Trudy Leningradskogo Instituta Imeni Lensoveta,* v. 40, 1957, p. 133-142.

Influence of an addition of colloid and surface tension lowering substance on the internal stresses in Cu, microhardness and cathode potential. Cu was precipitated from the solution of 250 g. per liter of $CuSO_4 \cdot 5H_2O$ + 50 g. per liter of H_2SO_5 at room temperature.
(P15, Q25h, C23; Cu)

556-P. (Russian.) **Ionization X-Ray Study of Bismuth Telluride Structure.** F. I. Vasenin and P. F. Konovalov. *Zhurnal Teknicheskoi Fiziki,* v. 26, no. 7, 1956, p. 1406-1414.

To investigate the nature of the sign inversion of the thermo-emf., an X-ray study near the stoichiometric composition Bi_2Te_3 was carried out. The thermo-emf. was measured before the alloy was pulverized (for preparing samples for X-ray photographing) by the method of compensation. X-ray photographing was carried out with an ionization installation. Two modifications of Bi_2Te_3 were observed.
(P15, M26q; Bi, Te)

557-P. (Russian.) **Study of Cathode Polarization on Electrolytic Precipitation of Nickel-Tungsten Alloys.** T. F. Frantsevich-Zabludovskaya and A. I. Zayats. *Zhurnal Prikladnoi Khimii,* v. 30, no. 5, 1957, p. 723-729.

Cathode polarization from tartaric ammonium electrolytes and structure of Ni-W precipitates studied. The Ni-W alloy separated with considerable depolarization with reference to W and insignificant depolarization with reference to Ni (30 to 60 mv.). The Ni-W alloy is a one-phase solid solution of W in Ni. The alloy lattice is face-centered cubic characteristic of Ni; the higher the W content, the more the lattice parameters increase.
(P15, N12d; Ni-b, W)

558-P. (Russian.) **Electrolytic Transfer of Carbon in Liquid Iron-Carbon Alloys.** M. A. Rabkin. *Zhurnal Prikladnoi Khimii,* v. 30, no. 5, 1957, p. 791-794.

Electrolytic transfer of C in liquid Fe-C alloys containing 0.72% Mn, 1.88% Si, 0.052% S and 0.074% P studied at 1300 to 1400° C. Carbon varied from 2.74 to 0.008%. A noticeable drop in concentration of C and S from the anode to the cathode took place, when a current of 0.08 to 0.1 amp. per sq. mm. was passing through at a voltage of 2.3 to 3 v. The greater the duration of the action of the electric field, the greater the concentration differences.
(P15; Fe-b, *C,* 14-60)

559-P.* **Photoconductivity in Chemically Deposited Films of Lead Selenide.** D. H. Roberts and J. E. Baines. *Physics and Chemistry of Solids, Journal,* v. 6, Aug. 1958, p. 184-189.

Measurements on photoconductive films of lead selenide indicate that a variation of the hydrazine hydrate concentration used in the deposition leads to a variation in the thermal and optical activation energies from 0.27 to 0.60 ev. This is explained by postulating the existence of potential barriers in the film produced by variations in the Fermi energy. 9 ref. (P17, P15; Pb, Se)

560-P.* **Extreme Frequencies of Lattice Vibrations for Disordered Binary Alloys.** G. F. Newell. *Physics and Chemistry of Solids, Journal,* v. 6, Aug. 1958, p. 190-194.

The extreme frequencies of various branches of the spectrum for a binary substitutional alloy can be estimated by using a variational procedure. In particular, the maximum frequency of the optical modes can be determined approximately as a function of the various force constants and the composition. 5 ref.
(P17, M26; N10)

561-P.* (English.) **Electrode Potential Behavior of Titanium in Solutions Initially Free From Metal Ions.** E. M. Khairy and M. M. El Khatib. *Egyptian Journal of Chemistry,* v. 1, no. 1, 1958, p. 47-55.

On the basis of experiments with Ti electrodes in unstirred buffer solutions of a pH range 1 to 12 and in the same solutions stirred with N or O, a protective film of TiO_2, covered in its turn with oxygen doublets, is assumed. Potential thought to be governed by a $Ti/Ti^{+++}/TiO^{++}$ system subject to varying overvoltage effects. Stirring with H, subjecting the electrode to reducing action of H and to high vacuum, activates its surface and reduces the potential for pH=O. Antimony plating increases potential. Computed equilibrium constant $^aTiO^{++}/^aTi^{+++} = 10^3$. 9 ref.
(P15m; Ti)

562-P.* (English.) **Electrode Potential Behavior of Titanium in Fluoride Media.** E. M. Khairy and M. M. El Khatib. *Egyptian Journal of Chemistry,* v. 1, no. 1, 1958, p. 65-73.

Behavior of spectrographically pure Ti rods in buffer solutions of pH 2 to pH 12 with dissolved potassium fluoride in varying concentrations. A protective layer of dioxide assumed on the Ti surface. A remarkable attack of the fluoride ions on the layer is thought to take place if they are present in a concentration greater than one mole, forming TiF_6—as well as on the metal, penetrating through pores of the layer and forming Ti^{+++} ions. 6 ref. (P15m; Ti)

563-P.* (English.) **Anodic Behavior of Titanium at Low and High Current Densities With Particular Reference to the Specific Effect of the Fluoride Ion.** E. M. Khairy and M. M. El Khatib. *Egyptian Journal of Chemistry,* v. 1, no. 1, 1958, p. 75-85.

Anodic behavior of Ti subjected to low current densities in buffer solutions of pH 1.81, pH 7.1 and pH 12, and subjected to high current densities in solutions of pH 1.81, pH 7 and pH 10.88 is studied both in the absence and presence of fluoride ions, ranging over a concentration of dissolved KF from 4 to 10^{-2}N. The presence of fluoride ions caused a remarkable corroding effect in acid media. Passivity up to O-evolution was observed over a larger range of current density in the absence of fluoride ions than in the presence of fluoride ions.
(P15; Ti)

564-P. (Czech.) **Temperature Dependence of Thermo-EMF of Gray Sn With Admixtures of Cd.** Petko R. Kamadziev. *Ceskoslovensky Casopis pro Fysiku,* v. 6, no. 4, 1956, p. 426-430.

The conductivity and thermo-emf. of gray Sn containing 2.8×10^{18} atoms of Cd in 1 cc. were measured in the range from −183 to +10° C. (P15g, 2-61; Sn)

565-P.* (Czech.) **Effect of Heat Treating Magnetic Soft Material in Magnetic Field on Some Magnetic Properties.** Vladimir Havel. *Hutnicke Listy,* v. 13, no. 7, 1958, p. 587-594.

Influence of heat treating in a magnetic field on the maximum permeability of cast steel with 4.8 to 6.5% Si and cold worked sheets containing 3% Si. Holding time near Curie temperature was 6 min. with maximum outside magnetic field of 300 A. per cm. Cooling velocity was controlled. Results showed substantial rise in maximum permeability value after thermomagnetic treatment, in comparison with results after heat treatment. 10 ref. (P16, 2-64; AY, *Si*)

566-P.* (Czech.) **Development of a Ductile Permanent Magnet Alloy.** Zdenek Tischer. *Hutnicke Listy,* v. 13, no. 7, 1958, p. 669-674.

Production of 20% Ni, 20% Fe, 60% Cu alloy. Mechanical and heat treatment to produce desired magnetic properties in isotropic and anisotropic states. Alloy exhibits high ductility, low hardness, good machinability and workability. 13 ref. (P16, Q-general; Cu-b, *Ni, Fe,* SGA-n)

567-P. (Russian.) **Investigation of the Effect of Iodine Impurity on the Physical Properties of Selenium.** M. I. Aliyev. *AzerbSSR elmler Akademii kheberleri, Izvestiya Akademii Nauk AzerbSSR,* no. 5, 1957, p. 9-25.

At low annealing temperatures (60 to 80° C.), an iodine impurity accelerates the crystallization of Se. As the annealing temperature is increased, the influence of the amount of impurity is gradually weakened and at 90° C. there is no difference in the degree of crystallization of pure Se and that with an impurity of iodine. Iodine impurity increases the electric conductivity, which is greatest with an iodine concentration of 0.1%. Iodine decreases the thermal emf., increases thermal conductivity.
(P11h, P15g, 3-69; Se)

568-P. An Introduction to Metallurgical Thermodynamics. J. N. Pratt. *Birmingham Metallurgical Society, Journal,* v. 38, June 1958, p. 56-75.

Important principles of thermodynamics and relevance to metallurgy.
(P12a, P12r, P12s)

569-P. Influence of Surface on the Physical Properties of Metals. R. W. B. Stephens. Paper from "Effect of Surface on the Behaviour of Metals", Philosophical Library, 1958, p. 71-100.

Methods of examination of magnetic, thermal and optical properties, with special reference to the electron theory of metals. 31 ref.
(P general, M25)

570-P. Guide to Ferromagnetic Ceramics. Pt. 1. How Ferrites Work, Properties of Soft Ferrites. George Economos. *Materials in Design Engineering,* v. 48, Sept. 1958, p. 96-101.
(P16; SGA-n, NM-f)

571-P. Cyclotron Resonance in Metals. M. Ya. Azbel and E. A. Kaner. *Physical and Chemistry of Solids,*

(*)Articles Available Through Photocopy Service; See Coupon, p. 75.

Journal, v. 6, Aug. 1958, p. 113-135. 23 ref. (P18m)

572-P. (German.) **Distribution of Calcium Impurities in Aluminum and Their Influence on the Electric Conductivity of the Metal.** A. Domony. *Acta Technica*, v. 21, no. 3-4, 1958, p. 295-306.

Calcium found in Al as a salt, rather than in metallic form, causes marked reduction in electrical conductivity, makes degassing more difficult. 12 ref. (P15g, 3-69; Al. *Ca*)

573-P. (Russian.) **New Method for Measuring Thermodynamic Characteristics of Hard Metals.** A. A. Zhykhovitskii and A. G. Golitskyn. *Zavodskaya Laboratoriya*, v. 24, no. 7, 1958, p. 128-129. 4 ref. (P12; EG-d)

574-P. (Russina.) **Study of Kinetics of Intermetallic Compounds.** V. M. Glazov. *Zavodskaya Laboratoriya*, v. 24, no. 7, 1958, p. 824-828.

Viscosimetric method used for volumetric study of slowly forming reactions in intermetallic compounds. 12 ref. (P13b; 14-68)

575-P.* **Low-Temperature Heat Capacity of Bismuth and Tungsten.** Warren DeSorbo. *Journal of Physical Chemistry*, v. 62, Aug. 1958, p. 965-967.

Heat capacities of Bi and W measured in the temperature region 15-90° K. At 298.1° K., the entropies of these two metals have been re-evaluated. That of bismuth is 13.56 ± 0.05 cal. g. atom^{-1} deg.$^{-1}$, while that of tungsten is 8.2 ± 0.2 cal. g. atom^{-1} deg.$^{-1}$. The variation in the Debye characteristic temperature in the liquid hydrogen-liquid nitrogen temperature region for Bi is similar to that chacteristic of "layer-like" lattices, while that for W is typical of some of the isotropic lattices. (P12r, 2-63; Bi, W)

576-P. The Useful Heat Capacity of Several Materials for Ballistic Nose-Cone Construction. J. R. Stalder. *National Advisory Committee for Aeronautics*, TN 4141, Nov. 1957, 19 p.

Heat absorption characteristics of Cu, Inconel-X, graphite, and Be. Significant weight saving in a ballistic missile heat sink by use of graphite or Be in place of Cu. Inconel-X was unsatisfactory because of its low thermal conductivity. Large errors in computed temperature distributions in materials can arise if the variation of thermal properties with temperature is not taken into account. (P12r, T24e, 17-57; Cu, Ni, Be, NM-k36)

577-P. Investigation of Alloys of Magnesium and Their Properties. Pt. 2. Thermal and Electrical Properties of Magnesium-Base Alloys. H. Baker. Dow Chemical Co. *U. S. Office of Technical Services*, PB 131436, Sept. 1957, 29 p. $.75.

Electrical resistivities for cast AZ31A and B, AZ63A, AZ81A, AZ91C, AZ92A, AM100A, EK30A, EK41A, EZ33A, HK31A, rolled HK31A and HM21XA, and cast HZ32A determined at room temperature and in some cases up to 500° F. The temperature coefficients of electrical resistivity were fairly constant ranging from 0.8 to 1.0 microhm per cc. per ° F. The temperature coefficients of thermal conductivity were all positive and decreased with increasing temperature. (P15g, P11h; Mg-b)

578-P.* (Polish.) **Solubility of Oxygen in Solid Silver.** Wladyslaw Domanski. *Archiwum Hutnictwa*, v. 3, no. 2, 1958, p. 81-96.

Thermodynamic analysis on the basis of experimental data. Probable occurrence of oxygen in solid Ag as chemical compound Ag_2O. Calculations give plain lineal relation for logarithm of the activity coefficient of Ag_2O. 8 ref. (P12e, P12b; Ag, *O*)

579-P. Hydrogen in Titanium and Titanium Alloys. D. N. Williams. Battelle Memorial Institute. *U. S. Office of Technical Services*, PB 121643, May 1958, 110 p. $2.50.

Reviews and correlates research information. Factors of most significance are the temperature dependence of hydrogen solubility in alpha and beta Ti, hydrogen partial pressure and alloy composition. These factors control absorption, embrittlement, degassing and many other changes observed in hydrogen-containing Ti alloys. (P12e, Q26s; Ti-b, *H*)

580-P.* **Anodic Behavior of Nickel: Pt. 1. Effect of Components of Electrolyte.** Nelson F. Murphy and Bharat C. Oza. *Virginia Polytechnic Institute, Bulletin*, v. 51, May 1958, p. 3-18.

Anode potential and current density at which Ni became passive was a reproducible value that increased as the temperature increased; effect of the chloride ion in destroying the passivity of Ni was studied quantitatively; presence of co-existing sulphate and chloride ions was shown to counteract the effect of Ni ions; limiting current density was increased by the presence of sulphate ion, the magnitude of the increase depending on the concentration of Ni in the solution. Boric acid did not affect the limiting current density very much at low concentrations of Ni ions, but had effect at higher Ni ion concentrations. (P15m; Ni)

581-P.* **Defects in Solids and Current Concepts of Radiation Effects.** G. J. Dienes. Paper from "Effects of Radiation on Materials", 1958, Reinhold Publishing Corp., p. 1-47.

Reviews radiation induced disturbances including vacancies, interstitial atoms, thermal spikes, impurity atoms, ionization effects, displacement spikes and replacement collisions. Theoretical calculations of the number of displaced atoms and threshold energy for displacement are compared with the results of experimental determinations for metallic and nonmetallic solids. Changes in electrical resistivity, dimensional changes, diffusion mechanism, stored energy, Young's modulus, shear stress, ductile-to-brittle transition and other mechanical properties upon exposure to radiation. 130 ref. (P-general, Q-general, M26, 2-67)

582-P.* **Radiation Effects in Metals and Alloys.** D. S. Billington. Paper from "Effects of Radiation on Materials", 1958. Reinhold Publishing Corp., p. 99-125.

Effects of neutron irradiation on density, thermal properties, magnetic properties, electrical resistivity, microstructure, crystal structure, hardness, yield strength, shear strength, Young's modulus, precipitation reactions and diffusion coefficients of metals and alloys. Influence of melting point, crystal structure, prior thermal and mechanical history, neutron flux, temperature, chemical environment, stress level and composition on the effects of irradiation. 54 ref. (P-general, Q-general, M26, M27, N1, N7, 2-67)

583-P.* **Effects of Radiation on the Core Components of Nuclear Reactors.** C. E. Weber. Paper from "Effects of Radiation on Materials", 1958, Reinhold Publishing Corp., p. 191-212.

Behavior under radiation of fuel elements, poison control elements and structural members; effect of radiation on dimensional stability, physical properties and mechanical properties. Designing reactor components to minimize radiation damage. 27 ref. (P10d, P-general, Q-general, T11, 2-67)

584-P.* **Effects of Radiation on Shielding, Moderators, and Auxiliary Components of Nuclear Reactors.** Gerhart R. Hennig. Paper from "Effects of Radiation on Materials", 1958, Reinhold Publishing Corp., p. 213-242.

Radiation damage and effect on physical and nuclear properties of shielding, associated nuclear materials, liquid moderators and solid moderators. 53 ref. (P18, T11, 2-67)

585-P.* **Bibliography: Effect of Irradiation on Solids.** Helen C. Friedemann. Paper from "Effects of Radiation on Materials", 1958, Reinhold Publishing Corp., p. 305-338.

Extensive bibliography lists material published through 1956 on theories considering mechanism of radiation damage and effects of irradiation on properties of metals and other solids. 779 ref. (P-general, Q-general, 2-67)

586-P.* (German.) **Contraction After Strain Observed on a Steel With 12% Chromium and 1% Molybdenum.** Karl Bungardt, Martin Bauser and Heribert Sychrovsky. *Archiv für das Eisenhüttenwesen*, v. 29, July 1958, p. 415-422.

A steel with 0.15% C, 12.6% Cr and 1.05% Mo was hardened and annealed and then subjected to tests to determine contraction after strain, its influence upon creep properties, relation to time of load application, creep period from which load is released, amount of load and temperature. The contraction after strain follows a logarithmic time pattern before reaching a limit. It is greater in proportion to the amount of stress applied as well as the temperature. 28 ref. (P10d, Q3; SS)

587-P.* **Mechanism of Growth of Uranium on Thermal Cycling in the Alpha Range.** S. F. Pugh. *Institute of Metals, Journal*, v. 86, Aug. 1958, p. 497-503.

Growth of wrought U bar during thermal cycling between room temperature and higher temperature in the range arises from the differences in expansion in the axial direction of the grains of the two components of the rolling texture, combined with a change in the mode of plastic deformation in this temperature range. At the upper cycling temperature, the internal stress is relaxed by a thermally activated process. 18 ref. (P10d, 2-61; U)

588-P.* **Effects of Radiation on Metals.** Michael Ference, Jr. *SAE Transactions*, v. 66, 1958, p. 47-53.

The effectiveness of materials in absorbing radiation; the basic

mechanisms of the interaction of radiation and matter—to determine the changes on the mechanical properties of materials; radiation as a convenient and economical source of energy for irradiation of chemical systems. 14 ref.
(P17c, Q-general; 2-67)

589-P.* Physical Constants, Crystal Structure, and Thermodynamic Properties. J. F. Smith. Paper from "The Metal Thorium", American Society for Metals, 1958, p. 133-147.

Crystallography; density, elasticity and hardness; linear coefficient of thermal expansion; melting point and heat of fusion; vapor pressure, heat of vaporization and boiling point; reported values for temperature dependence of electrical resistivity; emissivity; thermal conductivity and thermal diffusivity. 15 ref. (P-general; Th)

590-P.* Electronic Structure of Thorium Metal. Ted G. Berlincourt. Paper from "The Metal Thorium", American Society for Metals, 1958, p. 148-160.

Experimental data for the electronic specific heat, magnetic susceptibility, Hall effect, electrical resistivity, magnetoresistivity, superconductivity and thermo-electric effect of Th. 21 ref. (P15, P16; Th)

591-P.* Effects of Irradiation Upon Thorium. Frank G. Foote and J. Howard Kittel. Paper from "The Metal Thorium", American Society for Metals, 1958, p. 277-281.

Thorium and high thorium-uranium alloys are resistant to dimensional changes even at high burnups. Other properties, such as hardness, tensile strength and conductivity, show modest changes, but the situation with regard to tensile strength is not clear. 6 ref.
(P10d, Q-general, 2-67; Th)

592-P. (Book.) **Effect of Surface on the Behaviour of Metals.** 1958, 100 p. Philosophical Library Inc., 15 E. 40th St., New York 16, N. Y. 21 sh.

Lectures delivered at Institution of Metallurgists' Refresher Course 1957. Papers are abstracted separately. (P13, Q9)

593-P. (Book.) **Effects of Radiation on Materials.** J. J. Harwood, Henry H. Hausner, J. G. Morse and W. G. Rauch. 1958. 355 p. Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y. $10.50.

Experimental approaches to study; effects of radiation on physical, metallurgical and corrosion properties of metals and alloys. Effects on dielectric materials, semiconductors, nuclear reactor components and organic compounds. Papers abstracted separately.
(P-general, Q-general, 2-67)

Q Mechanical Properties and Tests

1065-Q.* Constitutional Factors Affecting the Tensile Properties of Wrought Aluminum-Magnesium-Silicon-Copper Alloys. D. L. W. Collins. *Institute of Metals, Journal,* v. 86, Mar. 1958, p. 325-336.

Tensile properties of solution treated and artificially aged alloys within the range 0.5 to 2.0% Mg, 0.3 to 1.2% Si and 0 to 1.5% Cu, related to equilibrium reactions at heat treatment temperatures. An isotherm for the Al-Mg-Si-Cu system at 520° C. is derived. Close correlation was found between mechanical properties and constitution, in particular the solid-solution composition when quenched. 18 ref.
(Q27a, 2-60, 2-64; Al-b, *Mg, Si, Cu*)

1066-Q.* Ductile Fracture Instability in Shear. F. A. McClintock. *American Society of Mechanical Engineers, Paper no. 58-A-12,* 1958, 7 p.

Theory to predict when cracking will initiate from a notch at nominal shear stresses below the yield stress; when the crack will become unstable on increase of stress; when unstable cracking will occur if a notch is cut while a constant nominal stress is maintained. (Q25, Q2)

1067-Q.* A Theory of Elastic, Plastic, and Creep Deformation of an Initially Isotropic Material Showing Anisotropic Strain-Hardening, Creep Recovery, and Secondary Creep. J. F. Besseling. *American Society of Mechanical Engineers, Paper no. 58-APM-17,* 1958, 8 p.

If the condition is imposed that all subelements of an element of volume are subjected to the same total strain, it is demonstrated that the inelastic stress-strain relations of the material show anisotropic strain hardening, creep recovery and primary and secondary creep due to the nonuniform energy dissipation in deformation of the subelements. 10 ref. (Q3, Q21, Q24)

1068-Q. Prediction of Transition Temperature in a Notched Bar Impact Test. J. R. Hendrickson, D. S. Wood and D. S. Clark. *American Society for Metals, Transactions,* Preprint no. 96, 13 p.

Concepts of the mechanism of the initiation of brittle fracture in mild steel were previously developed employing notched tensile specimens subjected to rapid loading at different temperatures. These concepts are now applied to obtain a prediction of the transition temperature as determined in the standard Izod impact test. The predicted transition temperature is found to agree remarkably well with the experimental value. 13 ref.
(Q23r, Q26s, Q6; CN)

1069-Q. The Effect of Composition on the Hydrogen Embrittlement of Alpha-Beta Titanium Alloys. R. I. Jaffee and D. N. Williams. *American Society for Metals, Transactions,* Preprint no. 98, 21 p.

Variables investigated were kind and amount of beta stabilizer; combinations of beta stabilizers; presence of Al or Sn, and interstitial level. The susceptibility to hydrogen embrittlement decreased as the amount of beta stabilizer (per cent of beta) and Al increased, but became greater as the oxygen content increased. Mo was the most effective beta stabilizer, and Fe and Mn the least. 10 ref.
(Q26s, 2-60; Ti-b)

1070-Q. 5% Chromium Ultra-High Strength Steel. John C. Hamaker. Paper from "High Strength Steels for Aircraft", American Society for Metals, 1958, p. 1-15.

A 5% Cr air hardening steel appears to be the best presently available for either ultra-high strength applications at room or low temperatures, or for elevated-temperature stability to 1000° F. In the 220,000-300,000-psi. tensile range, this steel provides significantly higher impact strength and ductility than low-alloy steels, and 20-35% higher fatigue strength than any air melted material previously reported. From 400-1000° F., its strength-to-weight ratio surpasses all materials including heat treated Ti alloys. 17 ref.
(Q-general, T24; AY, *Cr,* SGB-a)

1071-Q. Embrittlement of High Strength Steels. E. P. Klier. Paper from "High Strength Steels for Aircraft", American Society for Metals, 1958, p. 53-67.

Over-all problem of fracture in high-strength steels consists in establishing the conditions under which critical-sized fracture nuclei are generated and the load conditions under which the nuclei are converted into free running cracks. It is possible that microstresses are important in determining nucleation of a crack depending on their sign. 15 ref.
(Q26s; ST, SGB-a)

1072-Q. Acceptance Testing of High Strength Steels. Seymour Goodman. Paper from "High Strength Steels for Aircraft", American Society for Metals, 1958, p. 69-76.

Four high-strength steels in widespread use are SAE 4340, SAE 4330, HS-220 and Hy-Tuf. Still higher strength steels have been developed, including Tricent, Super Tricent, U. S. S. Strux and Hi-C-Super Hy-Tuf. Tests outlined include creep, short-time hot tensile and stability tests. (Q27a, Q3, 1-54; AY, SGB-a)

1073-Q. Properties and Application of 17-7 PH and Other Precipitation Hardening Stainless Steel Sheet for Airframes. R. W. White. Paper from "Sheet Materials for High Temperature Service", American Society for Metals, 1958, p. 1-9.

Typical tensile strengths of the 17-7 PH, PH 15-7 Mo, and AM-350 in the subzero cooled and tempered conditions. The creep properties of PH 15-7 Mo are superior to those of the original composition. AM-355 also has superior creep strength to AM-350. Applications include stringers, ribs, bulkheads, shrouds, honeycombs and skins. 3 ref.
(Q-general, 17-57, T24a; SS)

1074-Q. High Alloys of Chromium, Cobalt, Columbium, Molybdenum and Vanadium. H. R. Ogden. Paper from "Sheet Materials for High Temperature Service", American Society for Metals, 1958, p. 11-23.

Presently available V-base alloys will be useful up to about 1300° F., Co-base alloys up to about 1800° F., and Mo-base alloys up to about 2200° F. The limited data on Cr-base alloys indicate that they should have structural strength up to about 1800-1900° F. Co exhibits useful strengths at temperatures at least to 1800° F. 29 ref.
(Q-general, 2-62; V, Co, Mo, Cb, Cr, 4-53)

1075-Q. Relationship Between Surface Condition, Friction and Wear. F. T. Barwell. Paper from "Effect of Surface on the Behaviour of Metals", Philosophical Library, 1958, p. 43-68.

Nature of friction or contact; effect of naturally occurring oxide films; effect of temperature; fretting corrosion; pitting-type failure; scuffing. Nature of the oxide film and its relationship to its substrate. 28 ref. (Q9, R1f)

1076-Q. The Effect of Copper, Nickel, Iron and Chromium on the Tensile Properties of Preferentially Oriented Beryllium Sheet. F. M. Yans, A. D. Donaldson and A. R. Kaufman. *U. S. Atomic Energy Commission, NMI-1192,* 1958, 41 p. (Available from U. S. Office of Technical Services, Washington 25, D. C.)

(*)Articles Available Through Photocopy Service; See Coupon, p. 75.

Beryllium was mixed with Cu, Ni, Fe and Cr to form binary alloys in powder form, then extruded and cross rolled. The effect of each alloying element was determined by tensile testing. In solid solution, small amounts of Fe and Ni had an embrittling effect, while Cu in solution increased the strength but had no effect on ductility. The effect of Cr was complicated and not readily explainable. 6 ref.
(Q27a, 2-60; Be, 4-53, *Cu, Ni, Fe, Cr*)

1077-Q. (Russian.) **Problem of Plastic Deformation and Strengthening in a Sign Reversing Deformation.** F. P. Rybalko. *Fizika Metallov i Metallovedenie,* v. 2, no. 3, 1956, p. 376-377.

Hollow single and polycrystalline cylinders of Cu, subjected to sign-reversing torsion in strictly symmetrical cycles, experience an unequally deformed plastic deformation, during which various parts of the specimen are deformed and strengthened not simultaneously, but in sequence. The distribution of deformation along the specimen was determined from the twist angles of scribe marks drawn before the test parallel to the generatrix of the cylinder, and also from the appearance of sharply bounded regions of different shade on the surface of the specimen. The cause of such a separation of cylinders into regions is in this case, the different degree of deformation and strengthening of the middle and extreme parts of the specimens. (Q1, Q24; Cu)

1078-Q. (Russian.) **Coefficient of Transverse Deformation in the Plastic Region.** A. V. Gur'ev. *Fizika Metallov i Metallovedenie,* v. 2, no. 3, 1956, p. 457-463.

Coefficient determined for structural steel. In plastic tension, even for a round specimen, the deformation occurs in an extremely irregular manner over its volume. Compared with other investigations, a value of the coefficient that is closer to 0.5 was obtained.
(Q24; ST, SGB-s)

1079-Q. (Russian.) **Structure of the Slippage Tracks on the Surface of Deformed Aluminum Alloys.** N. N. Buynov. *Fizika Metallov i Metallovedenie,* v. 2, no. 3, 1956, p. 477-483.

Electron microscope investigation of hardened Al-Cu (4% Cu), Al-Si (1.2% Si) and Al-Mg-Si (1.4% Mg_2Si) alloys. Each elementary slippage track corresponds to a slippage over a packet of atom planes. The shear over these planes is not distributed uniformly. The degree of localization of the deformation in the slippage tracks is different in different sections of the alloy.
(Q24c; Al-b)

1080-Q. (Russian.) **Problem of the Effect of Lubricating Media on the Process of Penetration of a Sharpened Indentor Into a Plastic Metal.** V. D. Kuznetsov and A. I. Loskutov. *Fizika Metallov i Metallovedenie,* v. 2, no. 3, 1956, p. 509-513.

Effect of lubricants on the measurement of microhardness of commercially pure Fe, Cu and Zn. Measurements were carried out dry and with vaseline (inactive media), and also in 0.2% solutions of olein and stearine acids in vaseline oil (active media). The loading range was from 20 g. to 4 kg. Curves of the "depth of indentor penetration versus load" were plotted for each medium. Curves without lubricant and with vaseline-oil lubricants are identical.
(Q29q; Fe, Cu, Zn, NM-h)

1081-Q. (Russian.) **Fragmentation of the Surface of Polycrystalline Metals in Sign-Reversing Torsion.** F. P. Tybalko. *Fizika Metallov i Metallovedenie,* v. 2, no. 3, 1956, p. 514-520.

Various frequencies of sign reversals in the deformation and deformation amplitudes per cycle have been employed. Many polycrystalline metals, such as Cu, brass, Al, Pb, Sn and Zn with their alloys with Al have been used to establish that in case of viscous failure, regardless of the frequency of sign reversal and of the value of the deformation amplitude during the cycle, the surface of the specimens is fragmented by macrocracks into a system of rectangular blocks, the sides of which are directed along the planes of the maximum cleavage stresses. (Q1, Q26n, Q24)

1082-Q. (Russian.) **Strengthening of Aluminum and Magnesium-Base Alloys by Triple Metallic Compounds.** B. K. Vul'f and N. P. Shekalov. *Izvestiia Sektora Fiziko Khimicheskogo Analiza Institut Obshchei i Neorganicheskoi Khimii imeni Akademii Nauk SSSR,* v. 27, 1956, p. 198-208.

Investigation of Al-Cu-Mg, Al-Mg-Zn, Al-Cu-Ni, Al-Cu-Mn, Al-Mn-Ni, Mg-Cu-Zn, Mg-Ca-Zn, Mg-Al-Li alloys. Addition of triple metallic compounds in cast Al and pressed Mg alloys increases their hardness and strength. Plasticity of the alloy diminishes with increasing content of the triple compound. In hard Ag or Mg the hardness of the heat treated alloys increases upon aging. Good mechanical properties were exhibited by alloys of Al with 7.5% Al-Cu-Mg. The greatest strength was obtained for a Mg alloy with 19.4% Al_2MgLi.
(Q27a, Q29n; Al-b, Mg-b)

1083-Q. (Russian.) **Effect of Alloying Elements on the Temper Brittleness of Structural Steels.** V. I. Prosvirin and Ye. I. Kvashinina. *Termicheskaya Obrabotka i Svoystva Litoy Stali. M., Mashgiz,* 1955, p. 69-87.

Addition of Mo up to 0.5% prevents development of processes that cause temper brittleness in structural Cr-Ni-Mo and Cr-Mn-Mo steels. Greater additions of Mo (1% and above) do not affect the temper brittleness. Addition of tungsten (up to 1.6% for the 35KhGV steel) strongly retards the development of temper brittleness in structural steels. Additions of Ti, V and Cb do not prevent the development of temper brittleness.
(Q26s, 2-60; AY, SGB-a)

1084-Q. (Russian.) **Causes of Large Plastic Deformations in the Stretching of Metal Samples With Annular Grooves.** Yu I. Likhachev. *Zhurnal Tekhnicheskoi Fiziki,* v. 26, no. 8, 1956, p. 1841-1848.

Investigation of the boundaries of plastic regions constructed as the first approximation of the elastic-solution method on the basis of the Neiber solution has shown that large plastic deformations appear long before fracture in the elasto-plastic deformation stage of grooved plastic metal samples, because the plastic deformation region penetrates to the axis of the sample on both sides of the smallest groove cross section, and a closed plastic region containing the elasto-deformed nucleus is formed. (Q24)

1085-Q. Material-Property-Design Criteria for Metals: Pt. 6. The Conventional Short-Time Elevated-Temperature Properties of Selected Light Alloys. W. P. Achbach, R. J. Favor and W. S. Hyler. Battelle Memorial Institute. (Wright Air Development Center.) *U. S. Office of Technical Services,* PB 131515, Oct. 1957, 259 p. $6.

Data on alloys applicable to airframe and missile fabrication—2014-T4 and T-6; 2024-T3, T4, T6, T36, T81, and T86; 2218-T61; X2219-T6; 7075-T6 Al alloys; HK31A-T6 and HK31A-H24 Mg alloys; and Ti (8Mn) Ti alloy.
(Q-general, 2-62, T24; Al, Mg, Ti)

1086-Q. A Study of the Possibility of Reinforcing High-Temperature Alloys by Addition of Refractory Powders. J. D. Burney. P. R. Mallory & Co., Inc. (Wright Air Development Center.) *U. S. Office of Technical Services,* PB 131768, Feb. 1958, 48 p. $1.25.

Introduction of carbon to 80-20 Ni-Cr alloy forms a liquid phase in sintering which results in a high-density material having superior stress-rupture characteristics. Mere presence of carbon in the alloy does not insure the same increased stress-rupture properties. This indicates that the superior characteristics are indirectly due to a unique processing technique.
(Q3m, H12q; Ni, Cr, SGA-h)

1087-Q.* (French.) **Fatigue Testing of Welded Joints in Tubes and Plates.** W. Soete and J. Strebelle. *Revue de la Soudure,* v. 14, no. 2, 1958, p. 81-90.

Radiographic examination of a crane under construction was not sufficient to determine quality of the welded joints, constructed from flattened tube ends and plates. Fatigue tests show that the repeated tensile strength of the assemblies was around 3.8 kg./per sq. mm. When a 1.5 security factor was used, the calculated compression did not exceed 2.53 kg./per sq. mm. Radiographic examination was restricted to detection of large imperfections. Weakness was primarily due to the unusual form of the piece.
(Q7, S13e; ST, 7-51)

1088-Q. (Hungarian.) **Selection of the Proper Steel Type.** I. Mester. *Muszaki Elet,* v. 11, no. 8, 1956, p. 10-13.

Use of different types of steel and the effect of oxygen, nitrogen, hydrogen and alloying elements on properties. (Q-general, 17-57; ST)

1089-Q.* (Japanese.) **Hardness Tests.** Misao Mashimo. *Metal Finishing Society of Japan, Journal,* v. 9, May 1958, p. 31-34.

Typical devices recommended by Japanese Industrial Standards. 4 ref. (Q29, 1-53; ST, 8-62)

1090-Q.* (Japanese.) **Case Hardness Tests.** Eiichi Takeuchi. *Metal Finishing Society of Japan, Journal,* v. 9, May 1958, p. 35-38.

Physical methods are most efficient. Surface to be measured is prepared by polishing. Chemical methods are useful in measuring case depth. Microscopy is also helpful. (Q29, 1-54; ST, 2-64)

1091-Q. (Russian.) **Structural Features of Brittle and Viscous Fractures in Steel.** B. S. Kasalkin and B. A. Movchan. *Izvestiia Akademii Nauk SSSR, Otdelenie Tekhnicheskikh Nauk,* no. 5, 1956, p. 151-153.

X-ray structural analysis method was used to study brittle and viscous fractures in specimens made of NL2 and BSt3 steel with a substantial difference in sensitivity and cold brittleness. X-rays indicate that in the case of viscous failure the degree of reduction of the initial grains on the fracture surface exceeded the degree of reduction in brittle failure. Propagation of plastic deformation under conditions of brittle damage is determined. Results confirm that in spite of the visible difference in the character of the fracture, brittle and viscous failure are accompanied by a process of breaking down of the initial grains and a strengthening that is characteristic of plastic deformation. (Q26s, 3-68)

1092-Q.* On the Orientation Effect in the Polygonization of Bent Silicon Crystals. F. L. Vogel. *Acta Metallurgica,* v. 6, Aug. 1958, p. 532-534.

Experiments show that polygonization can readily occur in regions of a bent crystal where the deformation is primarily by single slip. By contrast, when slip on intersecting systems allows the formation of Lomer-Cottrell barriers, polygonization is absent. Thus explicit experimental evidence for the formation and immobility of Lomer-Cottrell barriers is obtained. 5 ref. (Q24a, M26c; Si)

1093-Q.* Dislocation Theory of the Fracture of Crystals. F. E. Fujita. *Acta Metallurgica,* v. 6, Aug. 1958, p. 543-551.

Mechanism for fracture is calculated with the theory of dislocation in elasticity and strain energy method. The calculation shows that a long flat void packed with a certain number of dislocations will be able to grow to be a large crack causing fracture, even if it is sufficiently small to be a stable crack in the crystal—for instance, a few atomic spacings in thickness and a few hundred atomic spacings in length in one dimension. 14 ref. (Q26r, M26b)

1094-Q.* Properties of Some Tungsten and Titanium Steels Containing Boron. A. Banerjee, D. K. Sood and P. Mehta. *Indian Institute of Metals, Transactions,* v. 9, 1955-1956, p. 143-160.

Effect of boron on the properties of low-carbon, low-alloy steels; influence of 0.5% Mo on steels containing 0.005% B; similarity in the effects of Mo, W and Ti in B treated steels; precipitation hardening in Mo-B steels; weldability of B steels. 25 ref. (Q-general, 2-60, K9s; AY, *Mo, W, Ti, B*)

1095-Q.* Temperature Dependence of Young's Modulus in Plain Carbon Steels. B. N. Das and S. K. Banerjee. *Indian Institute of Metals, Transactions,* v. 9, 1955-1956, p. 195-206.

Young's modulus of plain carbon steels with up to 1% C at room temperature falls into a narrow range of approximately 30.4 to 30.7 $\times$ 10^6 psi. In general there is a trend of gradual increase with increase in carbon content, but Mn seems to have a larger effect. 4 ref. (Q21a, 2-61; CN)

1096-Q.* Titanium at Temperature. H. R. Ogden. *Product Engineering (Design Digest),* v. 29, Sept. 1958, p. B2-B4.

Mechanical properties, thermal stability, oxidation and contamination resistance. (Q-general, 2-62; Ti)

1097-Q.* High-Strength Aluminum Alloy. Alan B. DeRoss. *Product Engineering (Design Digest),* v. 29, Sept. 1958, p. B6-B7.

Decrease in Fe content improves properties of Al casting alloy 356, permitting selection of a combination of properties suitable for structural parts. Q-general, 2-60; Al-b, SGB-a, SGB-s)

1098-Q.* Designing With PH Steels. *Product Engineering (Design Digest),* v. 29, Sept. 1958, p. B8-B11.

Applicable to 1200° F., precipitation hardening steels are affected by chemistry and heat treating variables. Brazing and welding precautions, mechanical and chemical properties. (Q-general, 17-51; SS)

1099-Q.* Ultra-Strength Steels. *Product Engineering (Design Digest),* v. 29, Sept. 1958, p. B13-B15.

Properties, composition, heat treatment, available forms, applications of AISI E 4340, AMS 6427 B, AMS 6428, Tricent, 5-317, Hy-Tuf, UHS 260, La Belle HT, HS 220, HS 260, Strux steels. (Q-general, 17-57; AY, SGB-s)

1100-Q.* Pearlitic Malleable Castings. O. K. Hunsaker. *Product Engineering (Design Digest),* v. 29, Sept. 1958, p. D7.

Readily cast, easily machined, with 45,000 to 80,000 psi. yield strength and 60,000 to 100,000 psi. ultimate tensile strength, pearlitic malleable can be hardened to Rockwell C-62. (Q27a, Q29n; CI-s)

1101-Q.* (French.) **Low-Temperature Internal Pressure Tests on Tubular Specimens.** Alfred Krisch. *Revue de Metallurgie,* v. 55, June 1958, p. 555-561.

Internal pressure tests combined with longitudinal stress at temperatures of 20, -30 and -70° C. on tubular specimens in two basic bessemer steels of different N and Al contents in annealed and in artificially aged conditions. With lowering of temperature, both steels showed decrease in deformation upon fracture. Specimens with low N content stretched prior to breaking. Elastic limit and tensile strength increased at low temperatures. Tests gave evidence of sharp differences between steels tested when subjected to biaxial stresses. Results were compared with results of tensile tests on cylindrical specimens. 8 ref. (Q21, Q27, Q10, 3-74; ST, *Al, N*)

1102-Q.* (French.) **Study of Laws of the Fatigue Process in Metals.** V. S. Ivanova. *Revue de Metallurgie,* v. 55, June 1958, p. 562-566.

Fatigue diagram is proposed according to which fatigue process is regarded as consisting of three periods: incubation, adaptation (during which slip occurs), and cracking. Method for experimental determination of length of each period permits construction of detailed fatigue diagrams of polycrystalline metals of polyhedric structure and establishment of laws of formation of cracks both within grain and at boundaries. For Armco Fe and Cu ratio of number of cycles causing appearance of adaptation (slip) lines within grains to number of cycles resulting in destruction of specimen has, for each metal, a constant value which is independent of stress. Diagrams for these two metals. 10 ref. (Q7; Fe, Cu)

1103-Q.* (French.) **Fatigue Phenomena During Combined Rolling and Slip.** A. G. Nikonoff. *Revue de Metallurgie,* v. 55, June 1958, p. 567-572.

Laboratory production of fatigue cracks and hardened layer that forms before appearance of cracks resulting from severe braking conditions in railroad car wheels. Fatigue tests on carbon and low-alloy steel specimens taken from wheels and treated by method described showed that the higher the mechanical properties, the finer the grain and the greater the quantity of lamellar structures in the metal, the slower is the formation of fatigue cracks. Increase in C content and proper heat treatment can provide these desirable properties. The hardest and most brittle surface layer forms on specimens with high carbon content, critical points at fairly low temperatures and low critical cooling rate. Mechanical properties do not appear to exert any great influence on cracks caused by braking stresses. Low-carbon steel (to 0.6% C) or low-alloy steel with up to 0.5% C, suitably heat treated, is recommended for wheels subject to severe braking. 6 ref. (Q7, T23; ST)

1104-Q.* (French.) **Initial Results of Research on the Hot Deformation of Steels. Application of a Specially Designed Apparatus.** C. Rossard and P. Blain. *Revue de Metallurgie,* v. 55, June 1958, p. 573-594.

Results of hot torsion tests on several types of steel at speeds ranging from 1 to 1000 rpm. and temperatures of 900 to 1200° C. For a given speed of deformation and a given temperature, stress attains a constant value, independent of deformation, only after a transitory period of damped oscillations, this period being characteristic of the given steel. These transitory periods are associated with phenomena of recrystallization which give rise to very different structures according to speed of deformation and temperature. A law of variation of characteristic stress as a function of deformation and temperature is deduced. Test equipment described. 20 ref. (Q1, 1-66, 1-53; ST)

1105-Q.* (French.) **Method of Graphical Determination of Transitory Phenomena During Hot Deformation of Steels.** C. Rossard and P. Blain. *Revue de Metallurgie,* v. 55, June 1958, p. 595-598.

Since in industrial processes correct rate of deformation often varies significantly with deformation, and since, for a given degree of deformation, stress under which hot deformation occurs depends not only on temperature, deformation and rate of deformation, but also on previous history of the metal, a method of graphical calculation is proposed which permits determination, on basis of a series of stress-deformation curves obtained at constant speed of stress variation as a function of deformation for any law of speed of deformation. 3 ref. (Q24, 1-54, Q25n)

1106-Q. (Russian.) **Mechanism of Plastic Deformation and Mechanical Properties of Aluminum. Pt. 2. Block Formation in Grains of Aluminum During Plastic Deformation.** E. S. Yakovleva. *Fizika Metallov i Metallovedenie,* v. 4, no. 1, 1957, p. 145-150.

(*)Articles Available Through Photocopy Service; See Coupon, p. 75.

Disoriented regions are formed in the grains during plastic deformation. Size and degree of disorientation of the resultant regions are not the same, if the conditions of deformation of the specimens are different. At low temperatures, these regions are made up by weakly disoriented small blocks. The total angle of disorientation of the blocks at 2% tension does not exceed 1° C. As the deformation increases, the disorientation angle increases, and the size of the blocks decreases. At 18% tension, the size of the block reaches an order of 10^{-4} cm. (Q24, M26c; Al)

1107-Q. (Rumanian.) **Investigation of Properties of Low-Alloy Manganese-Molybdenum Structural Steel.** B. Rotenstein. *Studii si Cercetari Metalurgie*, v. 11, no. 2, 1956, p. 261-282.

Influence of Mn, Cr, Mo, Cu and C on tension properties, impact, subzero properties, hardenability, susceptibility to reversible temper brittleness, sensitivity to thermal welding cycle and corrosion stability. Low-alloy Mn-Mo steel with small additions of Cu and Si can be used to make machine parts as a substitute for Cr-Ni steels or Cr-Mo steels, and also for structural and shipbuilding material.
(Q-general, 2-60; AY, *Mn, Mo*)

1108-Q. (Russian.) **Brittleness of Chromium.** S. T. Kishkin and I. O. Panasyuk. *Doklady Akademii Nauk, SSSR*, v. 113, no. 6, 1957, p. 1263-1264.

Threshold of cold brittleness of Cr is substantially affected by various gases. Oxygen, both dissolved and bound, increases brittleness at normal temperature. The most harmful impurity among the elements that form solid solutions is nitrogen. Purification of the metal should lead to reduction in the cold brittleness.
(Q26s, 2-63, 3-69; Cr, *O, N*)

1109-Q. (Russian.) **Relaxation of Stresses in Alloys of Aluminum With Magnesium.** M. G. Gaydukov and U. A. Pavlov. *Fizika Metallov i Metallovedenie*, v. 4, no. 1, 1957, p. 123-130.

Relaxation of stresses in temperature range from 100 to 300° C. with initial stresses of 300 g. per sq. mm. Increase in the relaxation stability of Al-Mg alloys, compared with pure Al is connected not with increase in the interatomic binding forces but with increase in the effectiveness of the binding forces. This is due to two factors; first, as the number of distortions increases, internal stresses are more uniformly distributed over the volume of the crystal; second, during diffusion, relaxation of stresses takes place near the regularities of the crystalline lattice, and a reduction in the degree of overstress takes place around them.
(Q3s, Q25h, M25h; Al-b, *Mg*)

1110-Q. (Russian.) **Concerning the Brittleness of Metal-Like Compounds.** V. S. Neshpor and G. V. Samsonov. *Fizika Metallov i Metallovedenie*, v. 4, no. 1, 1957, p. 181-183.

Coefficient of linear expansion of certain carbides, nitrides and borides of W, Mo, Ti and Zr determined, with their moduli of elasticity. On the basis of these quantities, the mean-squared displacements of the molecules of the corresponding compounds from their equilibrium positions in the crystalline lattice are calculated for the propagation of elastic waves. (Q26s, Q21, P10d; W, Mo, Ti, Zr, 14-68)

1111-Q.* Friction and Wear of Metals to 1000° C. E. P. Kingsbury and E. Rabinowicz. *American Society of Mechanical Engineers, Transactions*, Paper no. 58-LUB-6, 1958, 4 p.

Sliding experiments on Zn, Cu, Ti and 1020 steel carried out on a pin-on-disk friction apparatus incorporated in a metallurgical furnace. At room temperatures the results with steel, but not with the other metals, depended markedly on the atmospheric moisture content. As temperatures were raised to 400° C. the friction and wear rate of the steel reached a maximum at 100° C. and then diminished, while with the other metals the friction remained constant and the wear rate increased. 15 ref. (Q9, 2-62; Zn, Cu, Ti, CN)

1112-Q.* Strength of Welded Joints in Low-Alloy Steels at Elevated Temperatures. W. B. Hoyt. *American Society of Mechanical Engineers*, Paper no. 58-PET-34, 1958, 15 p.

Short-time tensile and creep-rupture tests on steels with 1% Cr, ½% Mo, and 2¼% Cr, 1% Mo. (Q27a, 2-62, Q3m; AY, *Cr, Mo*, 7-51)

1113-Q.* First All-Beta Titanium Alloy Has Strength of 240,000 Psi. *Materials in Design Engineering*, v. 48, Sept. 1958, p. 131-132, 134, 136.

Development by Crucible Steel Co. of three new high-strength Ti alloys. One, believed to be the first all-beta Ti alloy ever produced, can be heat treated to a tensile strength of 240,000 psi. and has excellent formability. The other two, available in sheet form, can be solution treated to a soft, easily formed condition and then aged to high room and elevated-temperature strength.
(Q27a, Q23q; Ti-b)

1114-Q.* High Strength Aluminum Alloy X357—Properties and Aging Practices. Alan B. DeRoss. *Modern Castings*, v. 34, Sept. 1958, p. 82-85.

Heat treating practices and mechanical properties; yield strength in the range of 43,000 psi. and ultimate strength above 50,000 psi. Exhibits castability, machinability, dimensional stability and corrosion resistance.
(Q-general, J27d; Al-b, 5-60)

1115-Q. Determination of the Mechanical Properties of Aircraft-Structural Materials at Very High Temperatures After Rapid Heating. J. B. Preston, W. P. Roe and J. R. Kattus. Southern Research Institute. (Wright Air Development Center.) *U. S. Office of Technical Services*, PB 131664, Jan. 1958, 206 p. $3.

Mechanical properties, tensile, creep, fracture, compression, shear and bending of several aircraft and missile structural materials under conditions of moderate to rapid rates of heating and of loading. Test materials included electrolytic tough-pitch Cu, oxygen-free high-conductivity Cu, A-nickel, ingot iron, Mo, Ta, Type-GBH graphite, and composite OFHC Cu plus 316 stainless steel sheet. Temperature ranges from room to the melting points of the metals and to 5750° F. for the graphite were used, with heating, holding, and loading times to failure ranging from 3 sec. to 30 min. The strength of the metals was found to decrease continuously with increasing temperature. (Q-general, 2-62, T24, 17-57; Cu, Ni, Fe, Mo, Ta, SS)

1116-Q. Effect of Prior Creep on Mechanical Properties of Aircraft Structural Metals: 2024-T86 Aluminum and 17-7 PH Stainless. J. V. Gluck, H. R. Voorhees and J. W. Freeman. University of Michigan. (Wright Air Development Center.) *U. S. Office of Technical Services*, PB 131716, Feb. 1958, p. 115 p. $2.50.

Specimens of 2024-T86 Al alloy and 17-7PH (TH 1050) precipitation hardening stainless steel were exposed for 10 to 100 hr. at stresses giving up to 3% total deformation, using temperatures of 350 to 500° F. for the 2024-T86 and 600 to 900° F. for the 17-7PH. Short-time tensile, compression or tension-impact tests were run at either room temperature, exposure temperature, or both. Results indicated that the short-time strength of structural materials may be raised or lowered. The changes in properties may be as much as 50% of the original value. (Q-general, Q3; Al-b, SS)

1117-Q. Studies and Comparison of the Properties of High-Temperature Alloys Melted and Precision Cast Both in Air and in Vacuum. M. J. Stutzman. Westinghouse Electric Corp. (Wright Air Development Center.) *U. S. Office of Technical Services*, PB 131807, Mar. 1958, 112 p.

Potentialities for improvement of mechanical properties at elevated temperature of heat resisting alloys by varied practices of melting and investment casting. Two Co-base alloys, Stellite 31 and He 1049, and two Ni-base alloys, Udimet 500 and Guy's alloy, were tested. Effects of melting and casting procedures upon gas content (hydrogen, oxygen, oxygen and nitrogen), tensile properties at room and elevated temperatures, stress-rupture properties in the range 1350 to 1800° F., and oxidation resistance to air at constant temperature of 2000° F. and intermittent exposure to air at room temperature and 2000° F.
(Q-general, 2-62, E10; Co, Ni)

1118-Q. Determination of the Mechanical Properties of a High Purity Lead and a 0.058% Copper-Lead Alloy. T. E. Tietz. Stanford Research Institute. (Wright Air Development Center.) *U. S. Office of Technical Services*, PB 131818, Apr. 1958, 43 p. $1.25.

Mechanical properties of a high-purity Pb and a 0.058% Cu-Pb alloy at test temperatures of 100, 175, 250 and 325° F. Tensile properties evaluated included ultimate strength, elongation, modulus of elasticity, proportional limit and yield strength. Compression properties studied were modulus of elasticity, proportional limit and yield strength. Ultimate shear strength and bearing yield strength and ultimate bearing strength were determined. Stress-creep time curves were obtained for total strain values of 0.2, 0.5, 1.0 and 2.0%, for creep times of from 1 to 500 hr.
(Q-general; Pb)

1119-Q.* (Czech.) **Graphs for X-Ray Measurement of Internal Macrostrains.** Miroslav Cermak. *Hutnicke Listy*, v. 13, no. 7, 1958, p. 594-598.

Graphs for determination of internal macrostrain for usual types of back reflection method, especially flat conical and cylindrical cases. 5 ref. (Q25, M22g)

1120-Q.* (German.) **Properties of Zinc-Copper Alloys From Spelter 98.8.** E. Pelzel. *Metall*, v. 12, Aug. 1958, p. 732-735.

For cast alloys, Cu up to 8% is necessary to eliminate coarse grain caused by Pb impurities, and to obtain adequate mechanical properties. At best these alloys are inferior, and use in casting is probably limited. Used as a rolled material, Zn-Cu alloys of a lower Cu content can be given the desired mechanical and technological properties by adequate heat treatment. 10 ref. (Q-general; Zn-b, *Cu, Pb*)

1121-Q.* (German.) **Influence of Vanadium Upon Some Characteristic Properties of Cast Iron.** Gunter Meckler. *Stahl und Eisen,* v. 78, June 26, 1958, p. 900-906.

Vanadium seems to have considerable influence upon structures, tensile strength (up to 450° C.) Brinell and Shore hardness after casting and after annealing at 500 to 800° C. It increases surface hardness and tensile strength, also under elevated temperatures. The actual cause for these property changes is cementite which increases the effect of V. 12 ref.
(Q-general; 2-60; CI-q, *V*)

1122-Q. (Russian.) **Softening of Plastically Deformed Metals.** V. N. Danilov. *Metallovedenie i Obrabotka Metallov,* no. 6, 1957, p. 15-16.

Softening of plastically deformed low-carbon steels (0.03% C), Al and Cu, annealed at temperatures somewhat above the recrystallization temperature, rolled in the middle portion of each specimen and subjected to deformation under stresses of 3, 1.8 and 0.8 kg. per sq. mm. respectively. Value of the thermal emf. between the center and the rolled ends of the specimens and the microhardness in various points were measured at different temperatures. The greater the deformation of the metal, the faster the softening process.
(Q24, N5; CN, Al, Cu)

1123-Q.* (Russian.) **Relation Between Wear Resistance, Microhardness and Crystal Lattice Distortion of Metals.** Yu. S. Terminasov and P. I. Ignatenko. *Vestnik Mashinostroeniya,* v. 38, Aug. 1958, p. 45-46.

X-ray was used in studying physical aspects. Objects tested for wear resistance in dry state and in oil, using steel ring 48 mm. diameter. Graphic presentation of connection between the surface microhardness and deformation in the crystal lattice shows relationship to be rectilinear. Thus, the greater the distortions in the crystal lattice of the worked-in surfaces the higher its microhardness.
(Q9n, Q29q, M26b)

1124-Q.* (Russian.) **Testing Armature Material by Resistance to Scratching.** A. V. Ratner and V. N. Gulyaev. *Zavodskaya Laboratoriya,* v. 24, June 1958, p. 770-774.

Tests applied to armatures working at steam pressure of 170-300 atm. and temperature of 560-650°. Test pieces are ground, flat objects approximating size of armature parts (diameter 20-100 mm.). Tests are conducted under steam (pressure about 1 atm.) with diminishing protective action of adsorptive layers and air. 4 ref. (Q29d, W11q)

1125-Q.* High Temperature Mechanical Properties of the New Magnesium Alloys. R. E. Bockrath. *Modern Metals,* v. 14, Sept. 1958, p. 52, 54, 56, 58.

Properties of sheet, plate, casting, extrusion alloys, including creep data up to 700-800° F.
(Q-general, 2-62, Q3; Mg-b)

1126-Q. Fretting-Fatigue Failure of Titanium-Steel and Steel-Steel Joints. W. L. Starkey, S. M. Marco and J. A. Collins. *Product Engineering (Design Digest),* v. 29, Sept. 1958, p. F15-F17.

Quantitative evaluation of the fatigue damage caused by fretting Ti against steel. Effects of shot peening and cold rolling as fretting inhibitors. (Q7, Q9q; Ti, ST)

1127-Q. (French.) **Disadvantages of Arc Welding.** J. Daivier. *Revue de la Soudure,* v. 14, no. 2, 1958, p. 119-122.

Experimental fatigue test data, radiographically and macrographically controlled, to determine most suitable welding conditions.
(Q7, K1; ST, 7-51)

1128-Q. (Russian.) **Method for Fatigue Estimation of Conveyor Driving Chains.** I. G. Shtokman and S. I. Lyakhovitskii. *Vestnik Mashinostroeniya,* v. 38, Aug. 1958, p. 23-26. 8 ref. (Q7, W12r; ST)

1129-Q. (Russian.) **Calculation of Tensions in Circular Objects Arising From Creep.** I. A. Oding and G. F. Lenin. *Zavodskaya Laboratoriya,* v. 24, no. 7, 1958, p. 845-848. 8 ref. (Q3, Q25)

1130-Q. (Russian.) **Study of Plastic Deformation in Circular Objects.** G. F. Lenin. *Zavodskaya Laboratoriya,* v. 24, no. 7, 1958, p. 849-850. (Q24)

1131-Q. (Russian.) **Determination of Plasticity of Low-Carbon Low-Alloy Steel.** I. A. Andreev, I. T. Baruzdin and L. Ya. Gluskin. *Zavodskaya Laboratoriya,* v. 24, no. 7, 1958, p. 855-858.

Heat precipitation test of shape changing cylindrical objects. 8 ref. (Q23; AY, 4-60)

1132-Q. (Russian.) **Device for Studying Relaxation of Stress After Torsion.** Ya. S. Gintsburg. *Zavodskaya Laboratoriya,* v. 24, no. 7, 1958, p. 865-867.
(Q1c, 1-53)

1133-Q. (Russian.) **Device for Studying Metal Friction at High Temperatures.** L. M. Feigin. *Zavodskaya Laboratoriya,* v. 24, no. 7, 1958, p. 869-870.
(Q9p, 1-53, 2-62)

1134-Q. Cermets as Potential Materials for High-Temperature Service. O. A. Sandven. *Advisory Group for Aeronautical Research and Development,* Rept. 99, Apr. 1957, 6 p.

Review of chemical, physical and mechanical properties of the most important and promising hard metals and cermet systems, with special attention to creep resistance and ductility. Some experimental results on the system CbC-TiC-Ni.
(Q-general, P-general; SGA-h, 6-70)

1135-Q. Mechanical and Engineering Properties of Commercially Available Titanium Alloys. *Advisory Group for Aeronautical Research and Development,* Rept. 100, Apr. 1957, 4 p.

Titanium alloys being produced on a commercial basis up to early 1957. Nominal chemical compositions and manufacturer's designations. Collection of published data on physical, mechanical and engineering properties. Properties required by the aeronautical design engineer that are not available.
(Q-general, S22; Ti-b)

1136-Q. A Survey of the Structural Properties of Some High-Strength Sheet Steels. M. A. Melcon. *Advisory Group for Aeronautical Research and Development,* Rept. 101, Apr. 1957, 12 p.

Developmental of high-strength sheet steels for aircraft applications. Heat treatable stainless steels are 420, 422, 422M, AM350 and 17-7PH; Tri-cent is a low-alloy steel and Thermold "J" a toolsteel. Mechanical properties at room and elevated temperatures; fatigue, creep, and stress-rupture data. Fabrication problems such as welding, machining and distortion during heat treatment. (Q-general, T24, 17-57; AY, SS, SGB-a)

1137-Q. Croloy 15-15N—an Austenitic Heat-Resistant Alloy for Severe Tubular Applications at Elevated Temperatures. J. F. Ewing. *American Society of Mechanical Engineers,* Paper no. 57-A-205, Dec. 1957, 10 p.

Development work and extensive service experience for Croloy 15-15N, an austenitic heat resistant alloy designed with superior long-time strength at elevated temperatures for applications between 1200-1500° F. Strengths established in the 1200-1500° F. range are superior to the established AISI Type 300 series of austenitic heat resistant alloys. Need for proper heat treatment to realize superior strength above 1200° F. for Croloy 15-15N.
(Q27a, 2-62, Q3m, 2-64; SS, SGA-h)

1138-Q.* Relief of Thermal Stresses Through Creep. H. Poritsky and F. A. Fend. *American Society of Mechanical Engineers, Transactions,* Paper no. 58-A-41, 1958, 9 p.

Equations for analyzing effects of thermal creep on stress distributions. In formulating these elastoplastic equations, the tensile test stress-strain creep data are extended to compound stresses by means of the Mises-Hencky hypothesis. The various equations are manipulated to yield a numerical procedure by means of which the stress and strain components are computed successively at the end of various time intervals. The resulting equations are applied to the axially symmetric problem of relief of thermal stresses in an infinitely long cylinder which is quickly heated to a parabolic temperature, and maintained at that temperature. (Q25p)

1139-Q.* How Radiation Damages Metals. M. J. Makin. *Atomics and Nuclear Energy,* v. 9, Sept. 1958, p. 318-322.

Effect of irradiation on tensile properties of a number of pure metals under various conditions. Very large increases in the yield strength have been observed in initially annealed materials and yield point phenomena have been found in irradiated Cu, Ni, Zr and Fe. The yield stress of pure metals shows only a slight temperature dependence before irradiation whereas, after irradiation, the yield stress is strongly temperature dependent, being much less at higher temperatures. 14 ref.
(Q27a, 2-67; Cu, Ni, Zr, Fe)

1140-Q.* Special Report on Temperature Resisting Mag-Thorium Alloy HK31. *Design News,* v. 13, Sept. 1, 1957, p. 18-19.

Hk31 contains 96.3% Mg, 3% Th

(*)Articles Available Through Photocopy Service; See Coupon, p. 75.

and 0.5 to 0.7% Zr. It possesses extraordinary resistance to creep and maintains excellent strength through the temperature range of 300 to 700° F.
(Q3, Q27a, 2-62; Mg-b, *Th*)

1141-Q.* Measurement of Residual Stresses in Alloy Steel Forgings. A. Barker and E. H. Hardy. *Institution of Mechanical Engineers, Proceedings,* v. 171, 1957, p. 581-596.

Measurement by a trepanning method and by Sachs method. Possibility of plastic yielding during machining operations in the Sachs method and effect of this on the residual stress distribution in water quenched mild steel cylinders. Determination of residual stresses in an induction-hardened roll.
(Q25h, 1-54; AY, 4-51)

1142-Q. Creep Deflections and Stresses of Beam-Columns. T. H. Lin. *Journal of Applied Mechanics,* v. 25, Mar. 1958, p. 75-78.

Calculation method for creep stresses and deflections, using integrating operators with Green's function to solve differential equation of equilibrium. Illustrative example is given for ideal H-section of 75S-T Al alloy, applying Shanley's creep hypothesis and his test data for 75S-T at 600° F. for constant stress within limited range (5000 ± 500 psi.) to varying stress over wider range (down to 750 psi.). Constant rate of deflection increase is shown for 1-10 hr. after loading.
(Q3, Q25; Al-b)

1143-Q. Stress-Raisers in Engineering Parts. (Digest of "Some Common Stress-Raisers in Engineering Parts".) G. A. Cottrell. Technical Report, British Engine, Boiler and Electrical Insurance Co., Ltd., New Series, v. 3, p. 91-112. *Metal Progress,* v. 74, Sept. 1958, p. 158, 160.

Stress-raisers of the same magnitude do not exert the same effect on different metals or even on different alloys of the same class. In general, most metals are notch sensitive, with the notable exception of cast iron and 18-8 stainless steel. Experiments have demonstrated that although the endurance limit of steel increases with tensile strength of unnotched specimens, it attains a maximum value of 160,000 psi. and then decreases with notched specimens.
(Q23s, Q25; ST, CI, SS)

1144-Q.* Cast Age-Hardenable Austentic Steels. E. A. Lange, N. C. Howells and A. Bukowski. *Modern Castings,* v. 34, Oct. 1958, p. 53-59.

Cr-Ni-P, Cr-Mn, and Cr-Ni-Mn-V steels for high-strength, nonmagnetic castings. Cr-Ni-P austenitic steel developed 100,000-psi. yield strength. Cr-Mn austenitic steels were brittle when heat treated to high strength. Modifying the Cr-Ni-Mn-V composition resulted in an alloy with good ductility and 100,000-psi. yield strength. A fourth type of age-hardenable austenitic steel, Mn-V, containing a minimum of alloying elements was developed. 4 ref. (Q27, Q23, 2-60; SGB-a, SS, *Cr, Mn, Ni, V*)

1145-Q. Investigation of the Compressive Strength and Creep of 7075-T6 Aluminum-Alloy Plates at Elevated Temperatures. W. D. Deveikis. *National Advisory Committee for Aeronautics,* TN 4111, Nov. 1957, 28 p.

Elevated-temperature compressive strength from room temperature to 600° F. and creep test results from 350 to 500° F. for V-groove edge-supported plates of 7075-T6 Al alloy. Test results are analyzed to verify procedures for estimating maximum strength for material stress-strain curves and creep-failure stresses from isochronous stress-strain curves. Strength and creep results are also compared with similar results for 2024-T3 plates.
(Q28g, Q3m; Al-b, 4-53)

1146-Q.* Internal-Friction Study of Aluminum Alloy Containing 4 Weight Percent Copper. B. S. Berry and A. S. Nowick. *National Advisory Committee for Aeronautics,* TN 4225, Aug. 1958, 88 p.

Low-frequency internal friction measurements in both torsional and flexural vibration during aging. Both polycrystalline and single-crystal specimens exhibit an initial internal friction peak at 173° C. (for a frequency of 1 cps.) after solution treatment and quenching. This peak shows all the characteristics of a Zener relaxation, including strong anisotropy. It falls on aging in a manner simply related to the decrease in the Cu concentration of the matrix. This peak is also sensitive to the reversion of Guinier-Preston zones. (Q22; Al-b, *Cu*)

1147-Q.* Some Observations Relating to Recovery of Internal Friction During Fatigue of Aluminum. S. R. Valluri. *National Advisory Committee for Aeronautics,* TN 4371, Sept. 1958, 30 p.

Effective heat of activation for the process is approximately 10,000 cal. per g. mol. Variation of recovery with stress level and history indicates that recovery becomes independent of stressing history more quickly at higher stress levels. This recovery may be associated with the establishment of a subgrain structure and the basic process then happening may be one of indefinite to-and-fro motion of some free dislocations within the subgrains.
(Q22, Q7; Al)

1148-Q.* Creep of Nickel, Copper, and Nickel-Copper Alloys. *National Bureau of Standards, Technical News Bulletin,* v. 42, Sept. 1958, p. 176, 177.

Tests were made at temperatures of 300°, 700° and 900° F. on initially annealed specimens of the two metals, and on a 70-30 Ni-Cu alloy, and a 30-70 Ni-Cu alloy. Data derived from tests made at 700 and 900° F. indicate that the 30% Cu alloy was far more creep resistant than the 70% Cu alloy, regardless of the time under stress. The strengthening effects of alloying were more pronounced as the time of stress was increased and the temperature decreased. These observations were confirmed when the two alloys were tested at 1200° F. (Q3, 2-60; Ni, Cu)

1149-Q.* The Generation of Dislocations by Thermal Stresses. P. Penning. *Philips Technical Review,* v. 19, 1957-1958, p. 357-364.

During the pulling of Ge and Si crystals from the melt, a process widely employed in practice, a non-uniform temperature gradient arises. As a result, thermal stresses are formed in the material which may cause plastic flow or even fracture. Experiments on influence of rate of cooling a Ge rod on the state of internal perfection of the material.
(Q25p, N3r; Ge, Si)

1150-Q.* High Silicon Additions Are Giving Aluminum Better Wear Properties. Richard M. Smith. *SAE Journal,* v. 66, Sept. 1958, p. 48-50.

Good wear properties and light weight of hypereutectic Al-Si alloys (greater than 11.6% Si) make it a likely candidate for pistons, cylinder liners, rocker arms, cylinder blocks and heads and brake drums. Effect and usefulness of phosphorus additions in controlling the size and dispersion of primary Si crystals.
Q9n, T21b, T21c, 17-57; Al-b, *Si*)

1151-Q. Interim Report on Creep Behavior of Zircaloy-2 and Zircaloy-3. W. D. McMullen. Westinghouse Electric Corp., Bettis Plant, Pittsburgh. *U. S. Atomic Energy Commission WAPD-TM-132,* Apr. 1958, 20 p.

Zircaloy-2 was found to have much better creep properties than Zircaloy-3 even though their tensile properties are quite similar. The difference was magnified at lower second stage creep rates and/or higher temperatures. Creep of Zr and the Zircaloys tends to follow theoretical high-temperature creep behavior in agreement with the temperature dependence of other mechanical properties of Zr. 20 ref.
(Q3; Zr-b)

1152-Q. Iron-Chromium-Aluminum Alloys. J. E. Srawley. Naval Research Laboratory. *U. S. Office of Technical Services,* PB 131676, Apr. 1958, 20 p. $.50.

Alloys containing up to 25% Cr and 11% Al produced by vacuum melting and hot worked by forging. Tensile properties at room and elevated temperatures were determined, and their resistance to oxidation in air and attack by the combustion products of residual fuel oils was studied.
(Q27a, 2-61, R1h, R7d; Fe, Cr, Al)

1153-Q. Static Strength of Cross-Grain 7075-T6 Aluminum Alloy Extruded Bar Containing Fatigue Cracks. Walter Illg and Arthur J. McEvily, Jr. *National Advisory Committee for Aeronautics,* TN 3994, Apr. 1957, 25 p.

Specimens were subjected to static tests to determine residual static strength. Small cracks resulted in disproportionately large reductions of static strength. Effects of biaxiality and ductility on notch sensitivity under static loading.
(Q27a, Q23s, 9-22; Al-b)

1154-Q. Effect of Cold Work on the Creep-Rupture Properties of a Series of Simple 18-8 Type Stainless Steels. Frank B. Cuff, Jr. and Nicholas J. Grant. Massachuetts Institute of Technology. *U. S. Office of Technical Services,* PB 127194, Feb. 1956, 37 p. (Available at Library of Congress, Washington, D. C. Microfilm $3, Photostats $6.30.)

Effect of cold work on the creep-rupture properties of a series of six simple 18-8 type stainless steels at 1100 and 1200° F. Compositional variation (15.7 to 21.8% Cr, 8.7 to 13.9% Ni and .042 to .075% C plus N) resulted in a M_s temperature variation from + 100° F. to absolute zero. A relationship was found among the compoistion, M_s temperature, recrystallization temperature and rupture-life. (Q3m, 3-68; SS)

1155-Q.* (German.) Investigation on the Grain Boundary Embrittlement of Complicated Die Forgings Made of AlZnCuMg.5. Wilhelm Rosenkranz. *Zeitschrift für Metallkunde,* v. 49, June 1958, p. 316-323.

On die forged pieces from this and other Al alloys intercrystalline fractures were observed along grain boundaries which resulted from varying deposits along these boundaries. These fractures were attributed to spontaneous recrystallization during deformation, which can be avoided through the addition of Fe, Mn and Cr. 8 ref.
(Q26s, N5, 2-60; Al-b, 4-51)

1156-Q.* Nuclear Radiation Effects on Materials. Gerald Reinsmith. *ASTM Bulletin*, no. 232, Sept. 1958, p. 37-47.

Effect on plain carbon steel, stainless steels, Ni, Zr, and Co alloys, as well as on several nonmetals. Sources of radiation, uses. 43 ref.
(Q-general, 2-67; CN, SS, Ni, Zr, Co)

1157-Q.* A New Approach to the Problem of Creep. J. Glen. *Iron and Steel Institute, Journal*, v. 189, Aug. 1958, p. 333-343.

Creep data are plotted in the form of log strain, log creep rate curves (strain rate curves) to show transitions in creep rate in their true perspective. A family of such curves either at constant stress or at constant temperature form a regular pattern so that strain rate curves of tests at lower stress or temperature can be estimated. Ordinary strain-time-creep curves can be obtained by integration. This enabled accurate extrapolation of creep for rupture tests. Results of tests on several Mn steels used to illustrate creep transition phenomena and extrapolation of creep curves. 12 ref. (Q3, Q25n; ST)

1158-Q.* Vickers-Knoop Hardness Conversion. Lloyd Emond. *Metal Progress*, v. 74, Sept. 1958, p. 97.

Tests to determine relationships between Vickers diamond pyramid hardness (DPH) numbers and Knoop hardness at lighter loads than the standard 500 g. Three types of material were used—a low-carbon steel (A 212), a high-carbon steel drill rod and Monel metal.
(Q29e; CN, Ni-b)

1159-Q.* Tap the Reserve Strength in Metal Parts. Dominic J. Graziano. *Product Engineering*, v. 40, Sept. 29, 1958, p. 44-47.

Equations and simplified design curves that will predict the maximum stress, moment and permanent deformation involved when pushing past the yield strength of a material under pure bending loads.
(Q25, Q5, T24, 17-51)

1160-Q. The Strengthening Effect of Beryllium on Zircaloy-3. R. E. Johnson and A. F. Steeves. Westinghouse Electric Corp., Bettis Plant, Pittsburgh. *U. S. Atomic Energy Commission, WAPD-TM-81*, Aug. 16, 1957, 25 p.

Ingots of Zircaloy-3 with 0.05, 0.15, 0.35 and 0.70% Be were melted by a double-consumable-electro-arc-melting process. Tensile strength increased with increasing Be content. After extruding and forging, the alloys showed considerably better properties than either Zircaloy-2 or 3. Hot tensile data indicated that the loss of strength with increasing temperature is not so great as that in the unmodified Zircaloys. 4 ref. (Q27a, 2-60; Zr-b, *Be*)

1161-Q. Phenomenological Relation Between Stress, Strain Rate and Temperature for Metals at Elevated Temperatures. Elbridge Z. Stowell. *U. S. National Advisory Committee for Aeronautics*, TN 4000, May 1957, 19 p. (Available at National Advisory Committee for Aeronautics, 1512 "H" St., N.W., Washington 25, D. C.)

Phenomenological relation suggested to account for the behavior of polycrystalline metals above the equicohesive temperature. The properties of the metal included in the relation are elasticity, linear thermal expansion and viscosity. The relation may be integrated under various conditions to provide information on creep rates, creep rupture, stress-strain curves, and rapid-heating curves.
(Q25n, Q21, P10f, P11g, 2-62)

1162-Q. Recovery of Embrittled Cadmium Plated Steel. H. H. Johnson, E. J. Schneider and A. R. Troiano. Case Institute of Technology. *U. S. Office of Technical Services*, PB 131654, Dec. 1957, 23 p. $.75.

Cadmium electroplate thickness influences the recovery rate of hydrogen-embrittled steel; the recovery rate decreases with increasing plate thickness. New and efficient technique for minimizing hydrogen embrittlement. (Q26s; ST, *Cd*, 8-12)

1163-Q. The Effect of Heat Treatment on the Stability and Creep Resistance of a Ti-Al-Mo Alloy. H. L. Gegel. Wright Air Development Center. *U. S. Office of Technical Services*, PB 131673, Jan. 1958, 24 p. $.75.

Ti-Al-Mo alloys heat treated to high strength have good stability and improved creep properties. Tests indicate that the stability of the alloy is inocuous and that transformation during testing helps to maintain the material strength. Mechanism of embrittlement by heat treatment.
(Q3, Q26s, 2-64; Ti-b, *Al, Mo*)

1164-Q. Theory of Creep of Dispersion-Hardened Alloys. J. Weertman. Naval Research Laboratory. *U. S. Office of Technical Services*, PB 131675, Apr. 1958, 11 p. $.50.

Creep equations derived for dispersion-hardened alloys. Following Schoeck, it is assumed that the rate-controlling process is the climb of dislocations over second-phase particles. At low stresses a first-power stress dependence is found; at intermediate stresses a fourth-power dependence; and at high stresses an exponential stress dependence. (Q3)

1165-Q. Tensile Properties of Inconel and RS-120 Titanium-Alloy Sheet Under Rapid-Heating and Constant-Temperature Conditions. George J. Heimerl, Ivo M. Kurg and John E. Inge. *National Advisory Committee for Aeronautics*, TN3731, July 1956, 29 p.

Rapid heating tests to determine the tensile strength of Inconel and RS-120 Ti alloy sheet heated to failure at uniform temperature rates from 0.2 to 100° F. per sec. under constant load conditions. Yield and rupture stresses obtained by rapid heating compared with yield and ultimate stresses from elevated-temperature tensile stress-strain tests for ½-hr. exposure. Applicability of master curves and temperature-rate parameters to the prediction of yield and rupture stresses and temperatures under rapid-heating conditions. (Q27a, 2-61; Ni-b, Ti-b, 4-53)

1166-Q. Effect of Atmosphere on Creep-Rupture Properties of a Nickel-Chromium-Aluminum Alloy. P. Shahinian and M. R. Achter. Naval Research Laboratory. *U. S. Office of Technical Services*, PB 131735, May 1958, 15 p. $.50.

Role of ductility in the effect of environment on creep and rupture properties was investigated employing a 76 Ni, 19 Cr, 4 Al alloy. Creep-rupture tests were conducted in air and in vacuum at 1300, 1500 and 1900° F. At low temperatures and high stresses, time-to-rupture was longer in vacuum than in air, but at high temperatures and low stresses the reverse was true.
(Q3m, 2-66; Ni-b, *Cr, Al*)

1167-Q. Metallurgical and Mechanical Characteristics of High-Purity Titanium Base Alloys. F. C. Holden, J. A. Houck, H. R. Ogden and R. I. Jaffee. Battelle Memorial Institute. (Wright Air Development Center.) *U. S. Office of Technical Services*, PB 131817, Apr. 1958, 120 p. $2.75.

Relationships between thermal history, microstructure and mechanical properties for high-purity Ti-base alloys: Ti-Al-Mo, Ti-O-Mo, Ti-O-Al-Mo, Ti-C-Mo, Ti-O-Mn, Ti-O-Cu, Ti-C-Cu and Ti-Cu-Mn. Mechanical test data include tensile and flow properties, impact behavior over a range of temperatures, hardness, aging, and cooling-rate test data. Basic physical metallurgical principles involved.
(Q-general; Ti-b)

1168-Q. A Summary of Compressive-Creep Characteristics of Metal Columns at Elevated Temperatures. R. L. Carlson and G. K. Manning. Battelle Memorial Institute. (Wright Air Development Center.) *U. S. Office of Technical Services*, PB 131825, Apr. 1958, 62 p. $1.75.

Study of the creep buckling of metal columns prior to collapse and at time of buckling. Solutions to creep buckling. Shanley's time-dependent tangent-modulus method has several practical advantages over other analytical solutions.
(Q3c, 2-62)

1169-Q. Effect of Prior Creep on Mechanical Properties of Aircraft Structural Metals. Pt. 2. 17-7PH Alloy (TH 1050 Condition). J. V. Gluck, H. R. Voorhees and J. W. Freeman. University of Michigan. (Wright Air Development Center.) *U. S. Office of Technical Services*, PB 131826, Apr. 1958, 100 p. $2.50.

Little change in mechanical properties of 17-7PH (TH condition) stainless steel sheet results from exposure to creep at 600 to 900° F. Exposures were conducted for 10, 50 or 100 hr. either unstressed or at stresses giving up to 3% total deformation. Exposure at 800 and 900° F. had relatively little effect on mechanical properties. Changes that did occur were generally an increase in properties, and no loss was noted in any case.
(Q3, Q-general; SS)

1170-Q.* (English.) Tests to Determine the Influence of Building up With Low-Hydrogen Electrodes on the Fatigue Strength of Medium-Carbon Steel Shafts. *Lastechniek*, v. 24, July 1958, p. 158-159.

(*)Articles Available Through Photocopy Service; See Coupon, p. 75.

Results of rotating bend tests on medium-carbon steel shafts with one layer of weld deposit indicates that an endurance limit of about 70% of the limit of unwelded material can be reached. (Q7a, L24; CN-p)

1171-Q.* (English.) On the Mechanism of Wear Between Metal Surfaces. G. Yoshimoto and T. Tsukizoe. *Wear*, v. 1, June 1958, p. 472-490.

Analysis of the mechanism of wear between metal surfaces dependent on distribution of real area of contact. Assumption of a simple model which represents profile curves of a metal surface allows theoretical deduction of relationships between applied load in the number or size of the individual areas. Further assumptions as to the nature of the sliding process enable deduction of three types of wear for steel or cast iron: mechanical wear, Fe_2O_3 film wear and Fe_3O_4 film wear. These theoretical conclusions form basis for discussion of relationships of velocity and load to wear. 13 ref. (Q9)

1172-Q.* (English.) A Simple Apparatus for Studying the Wear of Tungsten Carbide. J. Golden and G. W. Rowe. *Wear*, v. 1, June 1958, p. 491-498.

Apparatus for testing transfer of radioactive tungsten carbide to steel or Cu during moderate speed sliding under various conditions. Wear track forms a close spiral about 20 ft. long. Zones of metal plate can be treated differently and effects on transfer of active slider can be studied in detail from autoradiographs. 5 ref. (Q9, 1-53; W, 6-69)

1173-Q.* (German.) Hot Shortness and Grain Boundary Structure of Steel. Friedrich Erdmann-Jesnitzer and W. Bernhardt. *Archiv für das Eisenhüttenwesen*, v. 29, June 1958, p. 353-357.

On sulphur-containing steel at temperatures around 1000° C., an increased susceptibility toward hot fracture along grain boundaries was observed. This is attributed to a eutectic of iron and iron sulphide. Armco iron was subjected to critical stretching after recrystallization, annealing and sulphurizing of surface, then the specimens were annealed at 659° C. for 8 to 48 hr. After etching the orientation angles between crystallites were determined. It was found that sulphur diffuses preferably into grain boundaries, where the angle of disorientation is about 18° C. 21 ref. (Q26, 2-62, M27c; ST)

1174-Q.* (German.) Investigation on the Deformation Process of Iron-Silicon Alloys in Relation to Composition and Temperature. Franz Lihl and Eduard Buhl. *Archiv für das Eisenhüttenwesen*, v. 29, June 1958, p. 365-375.

A number of Fe-Si alloys (1.0% to 6.1% Si) were subjected to extensive mechanical tests. Influence of pre-annealing upon the curve in the notched bar impact strength temperature diagram between −100 up to 1000° C. was determined. Also the curve for tensile strength, fracture elongation and notched bar impact strength in relation to temperature was investigated for alloys between 4.5 and 5% Si. 12 ref. (Q-general, 2-60, 2-61; Fe, *Si*)

1175-Q.* (German.) Applicability of the Fatigue Strength Theory of F. Stuessi Upon the Results Obtained From Long-Time Fatigue Tests. Werner Stauffer and Alfred Keller. *Archiv für das Eisenhüttenwesen*, v. 29, July 1958, p. 411-414.

A three-dimensional diagram for the endurance limits is established from mean stress, stress amplitudes and the logarithm of the number of cycles. Also the equation for the Wochler diagram is developed. These theories then are applied to endurance test results on a carbon steel and eight alloyed high-temperature steels. 7 ref. (Q7; CN, SS, SGA-h)

1176-Q.* (German.) Heat Treatable Hot Working Steels: Mechanical Properties at Elevated Temperatures. Karl Bungardt and Otto Mulders. *Stahl und Eisen*, v. 78, Aug. 7, 1958, p. 1119-1126.

Influence of different tempering and testing temperatures on mechanical properties (P) of steels. Behavior varies according to formula $P=T_{0k}(19+\log t)$ where T = annealing temperature in °K, t = annealing time in hours. Tensile strength and 0.2% elongation limit decrease with tempering. Elongation and reduction of area are more irregular depending on steel composition. Materials with high retention of hardness and high resistance to heat show range of brittleness; with lower heat resistance and hardness retension plasticity increases steadily with testing temperature. (Q-general, 2-62; ST)

1177-Q.* (German.) Influence of Hydrostatic Pressure Upon Stress Deformation of Single Crystals. Peter Haasen and Andrew W. Lawson, Jr. *Zeitschrift für Metallkunde*, v. 49, June 1958, p. 280-291.

Influence of 5000 atm. hydrostatic pressure on stress-strain diagram of single crystals of Al, Cu, Ni, alpha-brass and polycrystalline Ni. The yield point was elevated in all cases, except on Ni single crystals, beyond the pressure coefficient of the modulus of elasticity. The crystal is work-hardened under pressure of 1 atm., which is indicated through an increase of yield stresses. 33 ref. (Q27, 3-74; Al, Cu, Ni, 14-61)

1178-Q.* (German.) Lattice Deformation and Residual Strains in Pure and Alloyed Aluminum Specimens After Stress Deformation. Eckard Macherauch and Paul Müller. *Zeitschrift für Metallkunde*, v. 49, June 1958, p. 324-331.

X-ray investigations were made on polycrystals of pure and alloyed Al (duralumin) after plastic deformation and measurements of residual strains were compared to theoretical residual lattice strains. The theory of G. B. Greenough was not verified. Rather a characteristic compression state of the first degree was found. The diagram of residual stresses in relation to plastic deformation had the same shape as the stress-strain diagram reduced by the factor 0.4. 26 ref. (Q25h, Q24, M26; Al)

1179-Q.* (Russian.) Embrittlement of 20KhN14S2 Steel During Aging at 500-650°. A. V. Tikhomirov, N. V. Sukhobokova and N. A. Tikhomirova. *Metallovedenie i Obrabotka Metallov*, Aug. 1958, p. 22-25. (Henry Brutcher, Altadena, Calif., Translation no. 4316.)

Investigation of austenitic stainless steel used in electric power construction which shows tendency toward intercrystalline corrosion and brittleness. Aging of steel at intervals of 500-650° C. shows tendency to brittleness with a lowering of plasticity and impact strength. The sharpest drop in impact strength takes place during first period of aging (i.e., the first 200-300 hr.). On further exposure impact strength decreases more slowly. Stabilization after tempering has no effect on aging process. (Q26s, Q6n, R2h; SS-e)

1180-Q.* (Russian.) Study of Action of Superheated Steam on the Rupture Strength of Austenitic Steel. E. A. Davidovskaya and L. P. Kestel'. *Metallovedenie i Obrabotka Metallov*, Aug. 1958, p. 29-33. (Henry Brutcher, Altadena, Calif., Translation no. 4318.)

Steel tube 102 to 68 mm. diameter tested at 600°. Superheated clean steam without salt admixture does not lower strength of steel at high temperatures. However, presence of different types of salt has effect on walls of steampipes and lowers their strength when subject to great stress. It is therefore important to guard against any salt admixtures in steam used in boilers. (Q27a, 1-66; SS-e)

1181-Q. Effect of Tool Design and Degree of Deformation on Distribution of Deformation in Pressed Steel Blanks. Yu. F. Chernyi. *Metallovedenie i Obrabotka Metallov*, Aug. 1958, p. 51-56. (Henry Brutcher, Altadena, Calif., Translation no. 4323.)

Tests made on heat resistant EI481 steel. Metallographic study of deformation on basis of reduction in size of original grains. The greatest nonuniformity in grain deformation was noted in peripheral zone of blanks. Least grain deformation was found in surface layers. As a result, metal in peripheral zone had a lowered plasticity. The identical size of grains in the cross-sectional area of pressed billets and blanks points to possibility of modulation of deformation process of grains of large ingots. (Q24, G1; AY, SGA-h)

1182-Q.* (Russian.) Influence of Increased Arsenic Content on Ductility of Rail Steel. F. F. Sviridenko, A. N. Popova and M. G. Fradina. *Stal'*, v. 18, Aug. 1958, p. 739-741.

Increasing As content from 0.13 to 0.25% has little effect on rail strength and does not alter its stability when tested on a ram impact machine. Tests were conducted after nine months aging. (Q23p, 2-60; ST)

1183-Q.* The Mechanical Properties and Heat Treatment Response of Zirconium-Uranium Alloys. W. Chubb and F. A. Rough. *American Society for Metals, Transactions*, v. 51, Preprint no. 84, 1958, 20 p.

Mechanical properties and heat treatment response of Zr alloys containing 0 to 100% U. Effect of typical heat treatments upon mechanical properties. Tensile properties, hardness and dynamic modulus data at various temperatures. Heat treatment response was determined primarily in terms of end-ouench tests from 900° C. Results show a consistent pattern of behavior and permit practical heat treatment schedules to be devised. 6 ref. (Q-general, 2-64, Zr, U)

1184-Q.* Hydrogen Embrittlement and Delayed Failure in Titanium Alloys. R. D. Daniels, R. J. Quigg and A. R. Troiano. *American Society for Metals, Transactions*, v. 51, Preprint no. 86, 1958, 17 p.

Hydrogen-induced delayed failure in an alpha-beta Ti alloy was sensitive to microstructure. A quenched

structure was less susceptible to delayed failure than aged or annealed structures. The tendency for delayed failure was magnified in all structures by an increase in hydrogen content or an increase in strength level. Hydrogen-induced delayed failure occurred by a process of crack initiation and controlled crack growth. Plastic strain resulting from creep tended to retard crack initiation. 12 ref.
(Q26s, 3-71; Ti-b, *H*)

1185-Q.* Some Low-Temperature Observations of 1020 Steel. F. S. Deronja and M. Gensamer. *American Society for Metals, Transactions,* v. 51, Preprint no. 87, 1958, 11 p.

At grain size ASTM 4, 1020 steel has a 68° F. higher ductile-to-brittle transition temperature than at grain size ASTM 6, in simple tension. A 100-fold increase in testing speed has the effect of narrowing the transition range. The temperature at which there is a decrease in fracture stress was found to coincide with the approximate temperature at which twins first appear. Small jogs were observed in the load-extension curves and were found to be essentially due to twinning. Twinning precedes crack nucleation and propagation in the brittle range, and above the transition temperature can occur before the yield point phenomenon. 8 ref.
(Q23, Q24, 2-63; CN)

1186-Q.* The Phenomenon of "Negative Creep" in Alloys. R. W. Fountain and M. Korchynsky. *American Society for Metals, Transactions,* v. 51, Preprint no. 91, 1958, 13 p.

Measured creep elongation is a sum of true plastic deformation and length changes, resulting from the structural instability of alloys. As a special case, the contraction caused by a metallurgical solid-state reaction during creep testing may outweigh the elongation due to the applied stress and result in a phenomenon termed "negative creep". From the examples of some Fe-W and Ni-Mo alloys, it is shown that the amount of contraction can be calculated from the known phase relationships and crystallographic data. Experimental results illustrating "negative creep" in these alloys. 15 ref. (Q3, P10d)

1187-Q.* The Effect of Heat Treatment on the Elevated Temperature Stress Stability of Titanium Alloys. M. L. Greenlee, G. A. Lenning, W. M. Parris and H. D. Kessler. *American Society for Metals, Transactions,* v. 51, Preprint no. 94, 1958, 18 p.

Effect of heat treatment on unnotched and notched tensile properties, notch-bend impact strength, and elevated-temperature stress stability were investigated for three commercial Ti alloys. Strength increases obtained by heat treatment were of the order of 65,000 psi. for the Ti-140A alloy, 75,000 psi. for the Ti-155A alloy and 25,000 psi. for the Ti-6Al-4V alloy. No decrease in notch ductility or indication of instability was observed at the maximum strength level obtained for the Ti-6Al-4V alloy. 3 ref.
(Q27a, 2-62, 2-64; Ti-b)

1188-Q.* Effect of Strain Rate and Temperature on the Compressive Flow Stresses of Three Titanium Alloys. A. J. Griest, A. M. Sabroff and P. D. Frost. *American Society for Metals, Transactions,* v. 51, Preprint no. 95, 1958, 10 p.

Compression studies on unalloyed Ti, Ti-6Al-4V, and Ti-4Al-4Mn alloys in the range 1450 to 1725° F., and at strain rates in the range 0.0002 to 0.01 in. per in. per sec. At hot working temperatures the flow stresses of Ti alloys were markedly sensitive to strain rate. Increase of flow stress with increasing strain rate was greater for the Ti-6Al-4V and Ti-4Al-4Mn alloys than for unalloyed Ti. 16 ref.
(Q28, 2-61, 3-68; Ti-b)

1189-Q.* A Simplified Procedure for Calculating Peak Position in X-Ray Residual Stress Measurements on Hardened Steel. D. P. Koistinen and R. E. Marburger. *American Society for Metals, Transactions,* v. 51, Preprint no. 102, 1958, 14 p.

New correction and calculation procedures for X-ray diffraction measurement of residual stresses in hardened high-carbon steels. Corrections for X-ray diffraction peak symmetry achieved by using standardized table of theta dependent, multiplicative factors based upon theoretical factors influencing diffractive intensity. Simplified parabola-fitting technique for establishing position of peak. Correlation of stresses measured by this technique with stresses measured by Christenson-Rowland technique and by a mechanical dissection technique. 7 ref. (Q25h, M22g, 1-54; ST)

1190-Q.* Stress Effects of Abrasive Tumbling. H. R. Letner. *American Society for Metals, Transactions,* v. 51, Preprint no. 104, 1958, 17 p.

Toolsteel specimens at four hardness levels were tumbled with aluminous abrasives under a variety of conditions and resulting surface stresses were measured. Behavior was observed for three initial stress conditions: stress-free surfaces, ground surfaces and heat treated surfaces. Residual stresses induced in initially stress-free steels by tumbling were compressive at the surface and decreased uniformly to zero at a depth of a few thousandths of an inch. The magnitude and depth of penetration of the stress increased with abrasive particle size. Maximum compressive stress at the surface increased and thickness of stress layer decreased with increasing steel hardness. Tumbling modified initial surface stresses and replaced them with its own characteristic compressive stress. 9 ref.
(Q25h, L10d; TS)

1191-Q.* Thermal and Mechanical Fatigue of Nickel and Titanium. Harry Majors, Jr. *American Society for Metals, Transactions,* v. 51, Preprint no. 105, 1958, 12 p.

Thermal and load cycling tests were conducted on 0.500-in. diameter (I.D.) thin-walled tubes of Ti and Ni in direct loading under a constant mean temperature. Stresses and plastic strains were obtained. Controlled loading conditions were maintained by automatic electric timing circuits and resistance heating of the specimens. Analysis of the microstructure shows the influence of thermal cycles. 11 ref.
(Q7j; Ni, Ti)

1192-Q.* The Application of Time-Temperature Parameters to Accelerated Creep-Rupture Testing. S. S. Manson, G. Succop and W. F. Brown, Jr. *American Society for Metals, Transactions,* v. 51, Preprint no. 106, 1958, 15 p.

Procedure for application of time-temperature parameters in determining isothermal creep-rupture curves when no previous data exist. Parameter constants and master curves determined over a wide stress range with a minimum expenditure of testing time. Isothermals are calculated for "17-22-A" steel and austenitic 16-15-6 alloy and the values are extended approximately two time cycles beyond the longest test necessary to develop master curves. Results of calculations are compared with isothermal data established by conventional test procedures. Concluded that the use of correct time-temperature parameters can greatly reduce required testing time. 15 ref. (Q3, 1-54; SS)

1193-Q.* High-Temperature Properties of Vacuum-Melted Superalloys. F. M. Richmond. *SAE Transactions,* v. 66, 1958, p. 193-199.

Improved high-temperature rupture strength and ductility of Ni-base superalloys has been obtained by vacuum melting and by certain modifications in the nominal chemistry. Melting technique. Tensile and rupture properties of five Ni-base vacuum-melted alloys for the temperature range 1000-1600° F. 10 ref.
(Q27a, 2-62, Q3, C25; Ni-b, SGA-h)

1194-Q.* Correlations of Brittle-Fracture Service Failures With Laboratory Notch-Ductility Tests. P. P. Puzak, A. J. Babecki and W. S. Pellini. *Welding Journal,* v. 37, Sept. 1958, p. 391s-407s.

Materials involved in the fractures included plain carbon steels from ships; A285 plain carbon and A212 C-Si steels from pressure vessels; A204 and A302 Mn-Mo steels from pressure vessels; A293 Ni-Mo-V steels from a pressure vessel and a turbine spindle; A293 Cr-Mo-V steel from retaining rings; 12% Cr cast martensitic stainless steels from ship propellers; and quenched and tempered 3½ Ni, 1% Cr steel from forged machinery components. 13 ref. (Q26s, Q23p; CN, AY)

1195-Q.* Design Values for Thermal Stress in Ductile Materials. B. F. Langer. *Welding Journal,* v. 37, Sept. 1958, 411s-417s.

Methods for application of strain-cycling data to practical design problems involving thermal stress. Multi-axial stress conditions, combined steady and alternating stress and cumulative damage. When the calculated thermal stress exceeds the yield stress of a ductile material, some of the commonly used concepts, such as the Soderberg diagram, must be modified. 18 ref.
(Q25p, 17-51)

1196-Q.* Thorium in Magnesium Technology. T. E. Leontis. Paper from "The Metal Thorium", American Society for Metals, 1958, p. 29-53.

Physical and mechanical properties of Mg-Th and Mg-Th-Zr alloys; effect of Zr, Mg, Zn and rare earth additions on mechanical properties; commercial cast Mg alloys containing Th; commercial wrought Mg-Th alloys. 12 ref.
(Q-general, P-general, 2-60; Mg, *Th*)

1197-Q.* Mechanical Properties of Thorium and High-Thorium Alloys. J. A. Milko, R. E. Adams and W. O. Harms. Paper from "The Metal

(*)Articles Available Through Photocopy Service; See Coupon, p. 75.

Thorium", American Society for Metals, 1958, p. 186-216.

Properties of bomb-reduced and iodide Th and of high-Th alloys. Results of tensile, compression, torsion, fatigue, impact and hardness tests, and effects of testing temperature and alloying additions. 15 ref. (Q-general, 2-61, 2-60; Th)

1198-Q. Another Turbogenerator Failure. R. James Landrun. *Metal Progress,* v. 74, Sept. 1958, p. 91-94.

Another failure in a turbogenerator similar to the accident in Toronto was due to the presence of fatigue cracks at ventilating holes. These acted as stress-raisers during temporary and minor overspeeding, inducing an almost instantaneous brittle failure which wrecked the machine, fortunately without human casualty.
(Q26s, Q7, W11q, 17-51; AY)

1199-Q. Material-Property-Design Criteria for Metals. Pt. 4. Conventional Short-Time Elevated-Temperature Properties of Selected Alloys. W. P. Achback, R. J. Favor and W. S. Hyler. Battelle Memorial Institute. *U. S. Office of Technical Services,* PB 131515, Oct. 1957, 258 p. $6.

Data on conventional short-time elevated-temperature properties of selected light alloys applicable to airframe and missile fabrication.
(Q-general, 2-62; T24)

1200-Q. (Book.) **Calculations of Deformations of Welded Metal Structures.** N .O. Okerblom. 234 p. 1958. H. M. Stationery Office, Atlantic House, Holborn Viaduct, London, England E.C.1. 15sh.

Translation of Russian text, issued in 1955, for calculating deformation arising during fabrication of welded structures. (Q24, 7-51)

1201-Q. (Book.) **Sheet Materials for High Temperature Service.** 74 p. 1958. American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio. $2.95.

Papers presented at the first Southwestern Metal Congress, Dallas, Tex., May 12-16, 1958. Papers abstracted separately.
(Q-general, 2-63, T24, 17-57; SGA-h, 4-53)

1202-Q. (Book—German.) **Handbook of Materials Testing. V. 1. Testing. Measuring Instruments.** Erich Siebel and N. Ludwig. 890 p. 1958. Lange & Springer. Reichpietschufer 20, Berlin 35, West Germany. DM 148.50.

Pressure, bending, tension and torsion, impact and hardness testing; nondestructive testing, metallography, composition analysis.
(Q-general, S-general, M-general, 1-53)

1203-Q. (Book—German.) **Handbook of Materials Testing. V. 2. Metals.** Erich Siebel. 754 p. 1958. Lange & Springer. Reichpietschufer Berlin 35, West Germany. DM 118.50.

Mechanical property tests at high and low temperatures, weld and wire testing, corrosion testing.
(Q-general, R11, 2-62, 2-63)

Corrosion

580-R.* (English.) **Strain Electrometry, Corrosion and Catalysis.** A. G. Funk, D. N. Chakravarty, H. Eyring and C. J. Christensen. *Zeitschrift fur Physikalische Chemie,* v. 15, no. 1-6, Apr. 1958, p. 64-74.

Effects of pH, ferrous ion concentration, oxygen and inert gases such as hydrogen and argon, as well as polarization effects, on the initial voltages and on the transients induced by straining on iron wire immersed in solution. Results are explained in terms of known catalytic and corrosive processes occurring at the electrode. Strain electrometry provides a valuable and relatively new approach to the problems of corrosion and catalysis. 15 ref. (R11a, R10c, P13c; Fe)

581-R.* (German.) **Effect of Trace Elements in Oxidizable Molten Metal and the Kinetics of Increased Concentration at Melt Surfaces.** Friedrich Erdmann-Jesnitzer and Hansfriedrich Hadamovsky. *Freiberger Forschungshefte,* no. B28, 1958, p. 32-35.

Oxidation stability of principal metal is enhanced whenever concentration of trace elements is increased at surfaces of the melt. Enrichment of all trace elements (excluding inert ones) at the surface is a general phenomenon, characterized by diffusion to outer melt surfaces and through the oxide lattice. It is due to primary oxidation of trace elements, their preferred diffusibility through the oxide lattice and dependent upon small atoms or ion size of trace element as well as low solubility in principal metal. Favorable oxidation stability of molten metal can thus be predicted. 5 ref.
(R1h, N14; Pb, Zn, Cd, Al, Bi)

582-R. (Hungarian.) **Effect of Titanium and Boron on the Corrosion Resistance of High-Purity Aluminum.** H. M. Gyenlesne. *Magyar Tudomanyos Akademia Muszaki Tudomanyok Osstalyanak Kozlemenye,* v. 12, no. 1-4, 1954, p. 365-376.

Grain-refining additions of Ti and B do not reduce the corrosion resistance of Al. Up to 0.6% Ti does not lower corrosion resistance; boron somewhat accelerates the dissolution of Al in sulphuric and hydrochloric acids, but the effects of B in technical Al is very small, since the main element which lowers corrosion resistance is Fe. No correlations can be deduced about the effect of these additions on resistance to corrosion by the atmosphere or by weakly corrosive media, but the effects are small.
(R3, R6, 2-60; Al-a, *Ti, B*)

583-R.* (Italian.) **Use of Aluminum in Contact With Other Metals.** A. Prati. *Ingegneria Meccanica,* v. 6, July 1957, p. 9-16.

Galvanic corrosion; galvanic behavior of Al. Review of recent studies of corrosion of Al in bimetallic couples; conclusions and recommended conditions for use of Al in contact with other metals. 6 ref. (R1a; Al, 17-57)

584-R. (Russian.) **Study of the Process of the High-Temperature Oxidation of Metallic Titanium in Water Vapor.** G. P. Luchkin and G. G. Il'in. *Fizika Metallov i Metallovedenie,* v. 2, no. 3, 1956, p. 521-523.

Oxidizability of Ti is higher in water vapor than in air. X-ray diffraction study shows that only the TiO_2 phase enters into the composition of the scale. Other phases (Ti_2O_3 and TiO) have not been detected by X-ray diffraction. The size of the grain of the scale diminishes monotonically from the outside portion to the surface of the metal. The greater oxidizability of Ti in water vapor is connected with the facilitated diffusion of O_2 through the layer of scale, which in turn is caused by its structural features. (R1h, 2-62; Ti)

585-R. (Russian.) **Problem of Oxidation of Molybdenum in the Temperature Range Above the Melting Point of MoO_3.** V. I. Arkharov and Yu. Kozmanov. *Fizika Metallov i Metallovedenie,* v. 2, no. 3, 1956, p. 566.

Speed of oxidation of Mo in air was measured at 900 to 1300° C., i.e., above the melting temperature of MoO_3 (793° C.). Speed was measured from the gain in weight of the specimen per unit surface area after 20 min. oxidation. Speed remains almost constant over a wide temperature range. Speed of oxidation depends substantially on the partial pressure of O_2. At 900° C. only MoO_3 can be detected by X-ray diffraction, and at 1100 to 1300° C. the specimens become covered with a thin film of MoO_2. Possible mechanism of the oxidation of Mo above the melting point of MoO_3.
(R1h, 2-62; Mo)

586-R. Effect of Metals on Lubricants. Pt. 2. Corrosion and Oxidation Stability at 400° F. J. B. Christian. Wright Air Development Center. *U. S. Office of Technical Services,* PB 131710, Feb. 1958, 35 p. $1.

Effects which metals and alloys used in various aircraft systems, and the fluids and lubricants employed in these systems, have on one another. The fluids were blended with various additives which improve their viscosity-temperature properties and retard oxidation. Corrosion and oxidation stability of a diester blend, a siloxane, and a silicate in the presence of various metal specimens. Lead was the only metal attacked by all fluids tested. It was also the only metal which caused significantly noticeable changes in the fluids.
(R7e; Pb)

587-R. Development of an Improved Corrosion Inhibitor for Water-Alcohol Solutions. D. B. Conklin, B. G. Peacock and J. E. Cole. Wyandotte Chemicals Corp. (Wright Air Development Center.) *U. S. Office of Technical Services,* PB 131781, July 1956, 82 p. $2.25.

For use with alcohol-water injection fluid for aircraft engines. It inhibits corrosion of steel, stainless steel and Al alloys, is soluble in methanol, ethanol, water or mixtures of the liquids, and lowers surface tension of the mixtures. Although the inhibitor is chemically compatible with hard water solutions, inhibition efficiency is inversely proportional to water hardness. The inhibitor is a mixture of dicyclohexyl-ammonium nitrate, urea and 1-nitropropane in an anhydrous methanol solution.
(R10b, R7f; ST, SS, Al)

588-R. (Russian.) **Composition of Rust Developing on Iron in Contact**

With Water and Air. I. V. Krotov. *Zhurnal Fizicheskoi Khimii*, v. 30, no. 8, 1956, p. 1696-1701.

The composition of old rust produced by Fe powder previously wetted with distilled water ground in a whirling grinder and rusting in air was studied by chemico-analytical and thermographic methods. Rust consists of gamma FeOOH, which loses the absorbed water when heated to 149° C. Gamma FeOOH transforms into gamma Fe_2O_3 at a further temperature rise. The process discontinues at about 290° C. The process of transition from gamma Fe_2O_3 into alpha Fe_2O_3 ends at about 676° C. (R3, R4; Fe)

589-R.* Corrosion Rate of Wrought Iron. *Product Engineering (Design Digest)*, v. 29, Sept. 1958, p. B5.

Improved wrought iron shows 20-25% better resistance to corrosion from industrial atmosphere, acid and salt water. (R3, R4b, R6; Fe-m)

590-R.* High Alloys to Combat Corrosion. Edward D. Weisert. *Product Engineering (Design Digest)*, v. 29, Sept. 1958, p. B16-B17.

Composition, corrosion resistance of Ni-Mo, Ni-Mo-Cr, Ni-Cr-Fe-Mo, Co-Cr-W-Ni, Co-Cr-W-C, Fe-Si, Fe-Si-Mo, Ni-Si alloys. (R-general; Ni-b, Co-b, SGA-g)

591-R.* Corrosion Properties of Titanium, Zirconium, Tantalum and Type 316 Stainless Steel. *Welding Engineer*, v. 43, Sept. 1958, p. 41-43.

Resistance in a wide range of acids, bases, and salts at room and elevated temperatures. (R6, R7, 2-62; Ti, Zr, Ta, SS)

592-R.* (German.) **Comparison Between Results of Exposure Tests in Industrial Air and Accelerated Corrosion Tests in Sulfur Dioxide Atmospheres.** A. Kutzelnigg. *Werkstoffe und Korrosion*, v. 9, July 1958, p. 429-434.

Roll of sulphur dioxide in corrosion reactions; Trestor apparatus for accelerated sulphur dioxide corrosion tests; uniformity of results achieved in apparatus. Dependence of water vapor condensation on time. Results of exposure tests in industrial atmosphere and accelerated tests show good agreement for Ni deposits, Zn-rich paints and varnish systems. 20 ref. (R3, R11q; Ni, NM-g)

593-R.* (German.) **Comparing Exposure Tests on the Corrosion Resistance of Passivated Galvanized Steel.** T. Biestek. *Werkstoffe und Korrosion*, v. 9, July 1958, p. 434-439.

Results of three-year exposure tests on galvanic Zn coatings passivated by 15 different chemical methods. Test atmospheres were industrial, urban, rural and marine. Considerable variation in corrosion resistance was observed with use of different acid and chromate solutions for passivating. Comparison of exposure and accelerated tests. 10 ref. (R3, R10c; ST, *Zn*, 8-65)

594-R.* (German.) **Corrosion of Steel Pipes in Refinery Equipment by Sulphur-Rich Crude Oil.** P. Csokan. *Werkstoffe und Korrosion*, v. 9, July 1958, p. 443-450.

Corrosion and its thermal decomposition products. Chemical analysis and X-ray investigation of corrosion products. Corrosion mechanisms. 22 ref. (R7a; ST, 4-60)

595-R.* Mechanism of Oxide Film Formation on Zirconium. O. Flint and J. H. O. Varley. *Physics and Chemistry of Solids, Journal*, v. 6, Aug. 1958, p. 213-222.

Surface condition of Zr controls both thermal and anodic oxidation. Effect of ultraviolet light. The interpretation suggested for these observations is in terms of the possible variation in electronic work function and defect state of the oxide depending upon the physical condition of the metal surface. These variations will affect the efficiency of anodic film formation, and a qualitative scheme of possible mechanisms whereby film growth is controlled is described. 11 ref. (R2r; Zr)

596-R. Thin Metal Films as Corrosion Indicators. R. B. Belser and F. E. Hankinson. Georgia Institute of Technology. (Wright Air Development Center.) *U. S. Office of Technical Services*, PB 131894, May 1958, 98 p. $2.25.

Need for a sensitive, easily inspected, economical corrosion indicator which would integrate, with respect to time, the total exposure of packaged material to corrosive conditions. Corrosion properties and rates of Fe and Mn films and of the bimetal pairs Fe-Cu and Fe-Au. Important role in metal film corrosion of the adsorbed gas layer normally present on glass substrates. This layer furnished oxygen necessary for small particles of the oxides of iron to form at random sites on the film. These subsequently became elements of electrolytic cells, and destructive oxidation of the film proceeded by electrochemical processes. (R11a, R2r, R10e; Fe, Mn, Cu, Au)

597-R.* (English.) **Effect of Temperature on the Electrode Potential Behavior of Titanium and Its Bearing on the Mode of Oxidation of the Metal.** E. M. Khairy and M. M. El Khatib. *Egyptian Journal of Chemistry*, v. 1, no. 1, 1958, p. 57-63.

Potential-temperature curves obtained from spectrographically pure Ti electrodes in air show a maximum and a minimum for the potential within the range 25-60° C. Curves from Sb plated electrodes reach the maximum and minimum values between 30 and 50° C. By exposing the electrodes alternately to hydrogen and high vacuum, their potential is activated and varies linearly from 25 to 50° C., having the temperature coefficient −6.4 mv. per °C. (R1h, P15; Ti)

598-R.* (Czech.) **Resistance of Ferrito-Pearlitic Steels to Corrosion in Water Vapor and in Combustion Products at Temperatures Above 530° C.** Bohumil Prenosil. *Hutnické Listy*, v. 13, no. 7, 1958, p. 603-612.

Growth of protective oxide layer. Effects of water vapor pressure, prestress, sodium phosphate contamination, contamination with sodium hydroxide on corrosion penetration. Presence of sulphur dioxide and oxygen in combustion products and their influence on corrosion. Comparison between corrosion resistance in water vapor and in combustion products. 13 ref. (R4d, R7d, 2-62; AY)

599-R. Rust Preventives. E. J. Colerick. *Lubrication Engineering*, v. 14, Aug. 1958, p. 350-354.

Metallic coatings; nonmetallic coatings; petroleum base rust preventives; volatile corrosion inhibitors. (R10, L-general)

600-R. Studies on the Oxidation Characteristics of High-Carbon Steel at Different Electrostatic Potentials. K. C. Som, R. Ganguly and G. P. Chatterjee. *Indian Institute of Metals, Transactions*, v. 9, 1955-1956, p. 183-193.

Specimens were charged to ± 12 volts. Rate of oxidation of a neutral specimen of high-carbon steel is greater than that of a positively or negatively charged specimen. The negatively charged specimen is less reactive in the initial stages of oxidation than the positively charged specimen. But the positively charged specimen becomes less reactive at later stages. 6 ref. (R1h; CN-r)

601-R. Selecting Materials to Avoid Cavitation Damage. William J. Rheingans. *Materials in Design Engineering*, v. 48, Sept. 1958, p. 102-106.

Various types of stainless steel and aluminum bronze provide the best resistance to cavitation erosion in hydraulic equipment. There is a wide variation in the resistance of similar materials, and a small change in a material's chemical content or properties can substantially affect its resistance to cavitation damage. (R2m; SS, Cu-s, *Al*)

602-R. (German.) **Electrolytic Passivation of Silver With the "Argalin" Process.** H. W. Dettner. *Metalloberfläche*, v. 12, July 1958, p. 197-199.

New method of producing a transparent, durable passivated layer on Ag surfaces. (R10c; Ag)

603-R. (German.) **Electrochemical Behavior of Bimetallic Electrodes and the Application of Their Overpotential Curves in Corrosion Research.** G. Bianchi and G. Caprioglio. *Werkstoffe und Korrosion*, v. 9, July 1958, p. 440-443.

The dependency of polarization voltage of a two-phase electrode upon situation and size of local cell surfaces, anodic and cathodic processes on local electrodes, direction and density of external current and the position of reference electrode are utilized for investigation of current density-voltage curves of electrodes which are corroded by local currents. 6 ref. (R1a, R11)

604-R.* Effect of Impurities Upon the Resistance of Magnesium Casting Alloys AZ92 and AZ63 to Corrosion. B. J. Nelson. *Modern Castings*, v. 34, Oct. 1958, p. 78-86.

Accelerated tests in NaCl-H_2O_2 by alternate immersion and in 3½% NaCl spray: various atmospheric exposures. (R3, R6, R11g, R11j; Al)

605-R. The Corrosion of Zircaloy-Base Fuel Alloys in High-Temperature Water. Stanley Kass. Westinghouse Electric Corp., Bettis Plant, Pittsburgh. *U. S. Atomic Energy Commission WAPD-TM-123*, Jan. 1958, 23 p.

Corrosion of Zircaloy-2 and Zircaloy-3 base alloys with uranium and without the addition of boron is characterized by the initial formation of a protective oxide film fol-

(*)Articles Available Through Photocopy Service; See Coupon, p. 75.

lowed by a breakdown of the film and general spalling. Corrosion resistance is affected by prior thermal history. Addition of minute amounts of B greatly influences the corrosion rates and heat treatment responses.
(R4, 2-62, 2-60; Zr-b, U)

606-R. An Investigation of Uranium Corrosion in 100° C. Water and 200° C. Steam at Atmospheric Pressure. Oliver M. Stewart, Warren E. Berry, Paul D. Miller, Dale A. Vaughan, John B. Schroeder, Frederick W. Fink and Charles M. Schwartz. Battelle Memorial Institute. *U. S. Atomic Energy Commission BMI-1271,* June 19, 1958, 15 p.

Material balance studied by examination of the phase composition and valence state of the corrosion product and by hydrogen-evolution measurements. The corrosion rates in atmospheric-pressure steam above 100° C. are lower than those obtained in tests carried out in water with a hydrogen overpressure. 9 ref. (R4, 2-62; U)

607-R. Stress Corrosion Cracking of Austenitic Stainless Steels. H. H. Uhlig, John Lincoln, Jr. and Richard A. White. Massachusetts Institute of Technology. *U. S. Office of Technical Services,* PB 128219, Apr. 1957, 56 p. (Available at Library of Congress, Washington, D. C.; Microfilm $3.60, Photostats $9.30.)

Transgranular stress-corrosion cracking of 18-8 Type 304 specimens in 42% $MgCl_2$ does not depend on rate of stressing, whether specimens are bent in 10 min. or a fraction of a second. Addition of hydrochloric acid to $MgCl_2$ decreases cracking time, whereas addition to sodium hydroxide increases cracking time. (R1d; SS-e)

608-R. Investigation of Intergranular Oxidation in Stainless Steels and High-Nickel Alloys. Clarence A. Siebert, Maurice J. Sinnott, Lynn H. DeSmyter and Robert E. Keith. Michigan University. *U. S. Office of Technical Services,* PB 131471, June 1955, 110 p. $2.75.

Chromel alloys ASM, ARM and D and Type 310 stainless steels were oxidized for 100-hr. periods in the stressed condition. Intergranular oxidation measurements were obtained microscopically. Influence of stress, increasing time and temperature, water-vapor content of the air and preferred orientation. Visual and magnetic examinations on the oxidized specimens and their oxides. (R2h, R1h; SS, Ni-b)

609-R.* (German.) Effect of Different Impurities on Corrosion Resistance of Super-Pure Aluminum in Water at High Temperature and High Pressure. A. Domony. *Acta Technica,* v. 21, no. 1-2, 1958, p. 123-139.

Corrosion resistance of high-purity Al alloyed with different amounts of Si, Fe, Ti and B. Only Al containing certain kinds and amounts of foreign phase constituents was resistant. Corrosion behavior strongly enforced not only by formation of oxide films and electrochemical behavior of phases against base metal but also by depolarizing effect of alloy phases. 10 ref. (R4, 2-60, 3-69; Al)

610-R.* (German.) X-Ray Investigations of Scale Layers on Sintered Iron-Aluminum Compacts. Franz M. Oberhauser. *Zeitschrift für Metallkunde,* v. 49, June 1958, p. 343-345.

At an annealing temperature of 1350° C. granular scale films are formed of alpha Fe_2O_3. The lattice size of alpha Fe_2O_3 scale seems to be a little bigger than that of pure alpha Fe_2O_3. At 1200° C. the scale is composed of a Fe_3O_4 intermediate layer and an outer layer of alpha Fe_2O_3 and Fe_3O_4.
(R2q, M26; Fe, Al, 6-72)

611-R.* Current and Potential Relations for the Cathodic Protection of Steel in Salt Water. W. J. Schwerdtfeger. *Corrosion,* v. 14, Oct. 1958, p. 446t-450t.

Cathodic protection of steel specimens exposed for 60 days to both stagnant and aerated city water, to which was added 3% by weight of sodium chloride. 8 ref.
(R10d, R4b; Sf)

612-R.* Processes of Electrochemical Corrosion. G. V. Akimov. *Corrosion,* v. 14, Oct. 1958, p. 463t-483t.

Theoretical considerations involved in determining the potential of hydrogen and oxygen electrodes. The theory of microcells is examined and some of the experimental data for processes with hydrogen depolarization reviewed. Influence of alloying elements on corrosion rates of metals in various media. Electrochemical cells with differential aeration, corrosion processes in a moisture film and atmospheric corrosion. 20 ref. (R1a)

613-R.* Corrosion Resistance of Ductile Iron. F. L. Laque. *Corrosion,* v. 14, Oct. 1958, p. 485t-492t.

Internal structure of ordinary gray iron, pearlitic ductile iron, ferritic ductile iron, malleable iron and mild steel compared. Differences in the amount of carbon present and in the form in which it occurs are responsible for some differences in the corrosion behavior of these materials. Data in acids, in neutral and alkaline solutions, in sea water, in the atmosphere and underground given. 14 ref.
(R-general, 3-71, CI-r)

614-R.* Long-Range Field Burial Study Probes Underground Corrosion. *Iron Age,* v. 182, Oct. 9, 1958, p. 77-80.

Corrosion of plain ferrous metals, low and high-alloy steel and iron, nonferrous metals in various soil types. (R8)

615-R. Pinhole Corrosion Testing of Aluminum-Clad, Nickel-Bonded Fuel Elements. C. L. Angerman and E. C. Hoxie. E. I. du Pont de Nemours & Co. *U. S. Atomic Energy Commission DP-269,* Feb. 1958, 24 p. $1.25. (Available from U. S. Office of Technical Services.)

A corrosion test was developed to indicate the quality of the bond between the Al cladding and Ni-plated U core of fuel elements. The rate of corrosive attack was found to be dependent on the distribution of the oxide phase in the bond. 11 ref. (R11; Al, Ni, U, 8-66)

616-R.* Influence of Radiation Upon Corrosion and Surface Reactions of Metals and Alloys. M. T. Simnad. Paper from "Effects of Radiation on Materials", Reinhold Publishing Corp., 1958, p. 126-143.

Changes in metal properties and changes in composition of ambient environment which result from nuclear irradiation and which influence surface reactions or corrosion. Corrosion of fissionable and nonfissionable metals in nuclear reactor by water or aqueous solutions. Influence of irradiation on gas-solid reactions; effect of proton radiation upon surface reactions. 34 ref.
(R-general, T11, N15, 2-67)

617-R.* (French.) Stress-Corrosion in Homogeneous Alloys. Ludwig Graf. *Corrosion et Anticorrosion,* v. 6, May 1958, p. 151-161.

Influence of mechanical strain on corrosion of mixed homogeneous crystals (Ag-Au; Cu-Au; Cu-Zn) in contact with chemical agents or with mercury. In the case of mercury the attack depended on the concentration of mixed crystals but was not influenced by inversion of proportion of crystal components. It reached a maximum at 50% Au. The increased activity of grain limits, or "effect of mixed crystals" is considered to be the initial cause of crack formation. 11 ref.
(R1d; Ag, Au, Cu, Zn)

618-R.* (French.) Standard Tests for Iron Corrosion and Cathodic Protection. *Corrosion et Anticorrosion,* v. 6, May 1958, p. 171-176.

Soil is tested as to structure and physical and chemical properties. Corrosion tests of Fe plates in different soil types established relation between corrosion intensity and ratio of water to air. Saturation limit of ground water determines the limits of active or passive iron behavior. The more this saturation limit is exceeded the weaker the effective cathodic protection on the Fe. Temperature and energy coefficients can be calculated. Cathodic protection has to be calculated according to soil resistance and aggressivity. 9 ref. (R8, R10d; Fe)

619-R.* (German.) Precipitation Processes and Intergranular Corrosion in Stainless Austenitic Chromium-Nickel Steel Containing Columbium. Karl Bungardt and Gustav Lennartz. *Archiv für das Eisenhüttenwesen,* v. 29, June 1958, p. 359-364.

Analytical and X-ray observations on a steel with 0.056% C, 17.93% Cr, 10.92% Ni and 0.54% Cb to determine the influence of quenching temperatures between 900 and 1200° C., annealing temperature between 500 and 800° C. and annealing time between 2 and 10,000 hr. Relation between separation processes and resistance against intercrystalline corrosion during tests in a copper sulphate-sulphuric acid solution. Formation of Cr carbides and Cb carbides followed through the various phases. (R2h, 2-64; SS, *Cb*)

620-R.* (German.) Electrochemical Properties of a Passive Austenitic Chromium-Nickel Steel, of a Chromium-Molybdenum Steel and Passive Electrolytic Chromium in Boiling 20% Sulphuric Acid. Carl Carius. *Archiv für das Eisenhüttenwesen,* v. 29, July 1958, p. 449-461.

The processes on passive electrodes under the influence of "Redox" potentials analyzed. Current density-voltage diagrams for a steel with 18% Cr and 8% Ni, one with 27% Cr and 2% Mo and for electrolytical Cr in boiling sulphuric acid of 20% concentration after polarization times from 2 to 50 hr. Corrosion velocities are measured

gravimetrically and compared. Corrosion current attacks the components Fe and Ni selectivity in the solid solution. 11 ref. (R6g; SS, Cr)

621-R. (Japanese.) **Indispensable Metals for Petroleum Industry.** S. Hijikata. *Metals,* v. 28, Sept. 1958, p. 641-646.

In the distillation process corrosion is mainly caused by sulphides, chlorides and organic acids. Most useful alloy is Cr steel (STB-35, STC-42E). If there is "below dew point corrosion", Cu alloy is better than STC-30, STC-42E, STC-42F. In the thermal cracking process up to 300° C., 4-6% Cr-steel is used. If H_2S is formed, lining of 11-13% Cr steel is preferable. In the re-forming process petroleum is heated at 500° C., so that stainless steel and Cr-Ni alloy are used. If lining is necessary, 405, 304 or 316 stainless steel is used. In general 316 or 317 steel is most reliable.
(R7a, T29n, 17-57; SS)

622-R.* (Polish.) **Mechanism of Formation of a Double-Layer Oxide Scale on Copper-Zinc Alloys.** Lucjan Czerski, Stainislaw Mrowec and Teodor Werber. *Archiwum Hutnictwa,* v. 3, no. 2, 1958, p. 113-123.

Oxidation was carried out in air at 900° C. on alloys containing 9 to 15% Zn. Compacted external layer composed of cuprous oxide formed as result of outward diffusion of Cu. Internal scale composed of bi-phase mixture of cuprous oxide and ZnO formed by inward diffusion of oxygen. Increasing concentration of Zn in the alloy raised ZnO content in the internal scale and resulted in increased rate of inward diffusion of oxygen. Contents of ZnO in internal scale decreased with increasing distance from metallic core. 15 ref.
(R1h, N1; Cu-b, *Zn*)

623-R.* (Russian.) **Role of Grain Size in Cavitation Erosion of Steel.** I. N. Bogachev and R. I. Mints. *Metallovedenie i Obrabotka Metallov,* Aug. 1958, p. 26-29. (Henry Brutcher, Altadena, Calif., Translation no. 4317.)

Metallographic analysis of ferritic and austenitic steels. Resistance to cavitation and erosion depends on grain size and character of grain boundaries. Intensity of cavitation is determined by joint effect of grain properties and boundaries. Results show importance of establishing relationship between cavitation-erosion resistance of steel and the properties of fine-grained steel structure. 5 ref. (R2m, 2-59; SS)

624-R.* **Erosion in Turbojet Fuel Nozzles.** H. R. Hazard, P. Gluck and R. W. Tate. *Mechanical Engineering,* v. 80, Oct. 1958, p. 58-60.

Laboratory procedure for simulating engine conditions. Radiochemical technique perfected for measuring erosion of a few millionths of a gram of material in a few hours.
(R1c, 1-54, T24b)

625-R.* **Corrosion of Metals by Uranyl Salt Solution Using S^{35}.** Gunji Shinoda and Tadao Sano. *Osaka University, Technology Reports,* v. 7, Oct. 1957, p. 365-378.

Stainless steel containing Cb had high corrosion resistance and those containing Mo, Cu and other components corroded considerably; concludes that it is dangerous to decide corrosion tendency from weight loss. Reaction between the oxidized metallic ion (anion) and the uranyl ion (cation) which has strong oxidizing power; some kinds of U compound will be formed.
(R6j, 1-59; SS)

626-R.* **Increasing the Acid Resistance of Stainless Steels.** *Platinum Metals Review,* v. 2, Oct. 1958, p. 117-119.

Cr steels with small (0.5%-1.0%) additions of Pt or Pd exhibit much lower corrosion rates in 20-50% H_2SO_4. 6 ref. (R6g; SS, *Pt, Pd*)

627-R.* **The Corrosion of Thorium and Its Alloys.** W. E. Berry, R. S. Peoples and H. A. Pray. Paper from "The Metal Thorium", American Society for Metals, 1958, p. 267-276.

Reaction with gases; reaction with water; effect of alloy additions on corrosion of Th in high-purity water; solubility of Th in liquid metals. Th metal as a nuclear fuel appears to offer few corrosion problems in most liquid metal-cooled power reactors. On the other hand, apparently neither it nor its alloys are adequately resistant to water at temperatures of interest in pressurized water reactors. 12 ref. (R-general, R4, T11g; Th)

628-R. **Magnesium Anodes.** *Modern Metals,* v. 14, Sept. 1958, p. 36-37.
(R10d, 17-57; Mg)

629-R. **Underground Corrosion.** *National Bureau of Standards, Technical News Bulletin,* v. 42, Sept. 1958, p. 181-186.
(R8)

630-R.* (Pamphlet.) **Development of Wrought Aluminum-Magnesium Alloys.** E. H. Dix, Jr., W. A. Anderson and M. Byron Shumaker. *Alcoa Research Laboratories, Technical Paper no. 14.* Aluminum Co. of America, Pittsburgh, 1958, 63 p.

Results of extented stress-corrosion tests on Al-Mg alloys. Influence of alloy composition, strain hardening, hot forming, stress-relief, aging at atmospheric and elevated temperatures on resistance to stress-corrosion. Emphasis on properties of alloy 5456 and 5454. 93 ref.
(R1d; Al-b, *Mg*)

8 Inspection and Control

607-S.* (Japanese.) **Testing Tin-Plate.** Yoichi Kitamura. *Metal Finishing Society of Japan, Journal,* v. 9, May 1958, p. 3-12.

Thickness of tin-plate is measured by chemical, electrolytic, electromagnetic, beta-ray and X-ray analysis. Pinhole and endurance tests are done chemically. Thin oxide film is measured by electro-stripping method. Thickness of oil film is measured by extraction and repeated friction methods. These methods are applicable for both hot dipped tin-plate and electrolytic tin-plate. (S13, S14; ST, *Sn,* 8-62, 8-65)

608-S.* (Japanese.) **Testing Galvanized Iron.** Kiyoshi Segawa. *Metal Finishing Society of Japan, Journal,* v. 9, May 1958, p. 12-16.

Appearance test is useful. Chemical methods are applied in thickness, uniformity and impurity tests. Endurance is tested by water spray method, exposure method and rust measurement. Stripping test is mechanical. Deformability, tension and hardness are also tested. Stripping test is most important. 4 ref.
(S13a, S13b, R-general, 1-54; ST, *Zn,* 8-65)

609-S.* (Japanese.) **Testing Acid-Proof Enamel, Glass Lining and Ceramic Coating.** Kokichi Tanaka. *Metal Finishing Society of Japan, Journal,* v. 9, May 1958, p. 16-20.

Standard practice for testing advocated. Testing glass linings and ceramic coatings should include endurance, instantaneous heating and cooling, mechanical strength and pinhole and crack tests. Testing of acid-proof enamel should also include endurance acid resistance tests.
(S13a, S13b, S13m; NM-f42, NM-g34)

610-S.* (Japanese.) **Current Physical Methods for Thickness Measurement.** Mitsuo Sugimoto. *Metal Finishing Society of Japan, Journal,* v. 9, May 1958, p. 26-31.

Magnetic method for thickness measurement of thin films is applicable up to 2000 microns. Magneto-induction method is useful in the same range. High-frequency eddy current method can compensate magnetic method and is applicable for diamagnetic samples. Thermocouples have been applied recently and can measure 0.5 to about 1.5×10^{-3} in. Error is of the order of $\pm$ 5%. 10 ref. (S14, X20c)

611-S.* (English.) **Analysis of Microquantities of Antimony, Tin and Arsenic in Ferrotungsten.** Hidehiro Goto, Yachiyo Kakita and Masahiko Sase. *Tohoku University, Science Reports of the Research Institutes,* v. 10 no. 3, June 1958, p. 207-211.

Procedure for spectrophotometric determination. 5 ref.
(S11k; As, Fe, Sb, Sn, W, AD-n)

612-S.* (English.) **Spectrophotometric Determination of Germanium With Quercetinsulfonic Acid.** Takuji Kanno. *Tohoku University, Science Reports of the Research Institutes,* v. 10, no. 3, June 1958, p. 251-258.

Use of 3, 5, 7, 3', 4' pentahydroxyflavon-6'-sulphonic acid (quercetinsulphonic acid) for photometric determination of Ge. 12 ref.
(S11a; Ge)

613-S.* (Czech.) **Determination of Iron in Blast Furnace Iron Ores.** Jan Michal and Jaroslav Zalud. *Hutnické Listy,* v. 13, no. 7, 1958, p. 639-641.

Decomposition of specimen with perchloric and phosphoric acids. Reduction of trivalent Fe to bivalent with Ag reducer and titration with potassium bichromate.
(S11j; Fe, RM-n)

614-S.* (Czech.) **Polarographic Determination of Indium.** D. Weiss. *Hutnické Listy,* v. 13, no. 7, 1958, p. 641-643.

Polarographic method for determination of In in slightly acid chloride environment. Masking and removing interfering influence of V, Cd and other elements. Method has high sensitivity. (S11m; In)

615-S.* (Japanese.) **Sampling of Castings.** Kazuo Yasuda. *Metals,* v. 28, July 1958, p. 495-498.

Anisotropy of castings is caused by gravity, incomplete diffusion in solid phase and speed of cooling. Test pieces, taken from small and rapidly cooled samples, should be from different parts of the sample. Quartering is necessary. Correct sampling is very important in spectroscopic analysis. 14 ref.
(S12h, S11k; 5-60)

(*)Articles Available Through Photocopy Service; See Coupon, p. 75.

616-S. (French.) **Rapid Radiometric Determination of Uranium and Thorium in Complex Ores.** G. Jurain and P. Maillot. *Journal de Physique et le Radium,* v. 19, suppl. to no. 4, Apr. 1958, p. 35A-37A.

Method based on two gamma activity measurements carried out with series of scintillation counters and by fixing two different values of gain of pre-amplifier. Two results are thus obtained and these, associated with results obtained by standardization, allow calculation of percentages of U and Th. This method is applicable only to ore in radioactive equilibrium.
(S11q; U, Th, RM-n)

617-S. (French.) **Determination of Vanadium in Metals (Ferrovanadium, Vanadium Alloys, Etc.) and in Vanadic Acids.** F. Nouyrigat. *Societe Chimique de France, Bulletin,* June 1958, p. 781-785.

It is possible to determine amounts of V to within about 0.1% by conducting entire analysis under control of a potentiometer and suitably modifying apparent potential of $Fe^{2+} \rightleftarrows Fe^{3+}$ system by means of a complexing agent (H_3PO_4, for example). 16 ref.
(S11m; V)

618-S. (German.) **A Newly Developed Method for the Immersed Ultrasonic Transmission Testing of Metal Plates and Its Comparison With the Frequency Modulation Method.** I. Egri. *Acta Technica,* v. 21, no. 3-4, 1958, p. 327-343.

Possible error in new method is smaller, permitting either detection of smaller flaws, or greater inspection speeds. 3 ref. (S13g)

619-S. (German.) **Quantitative Spectrochemical Analysis of Spelter.** O. Werner. *Metall,* v. 12, Aug. 1958, p. 697-707.

23 ref. (S11k; Zn)

620-S. (German.) **Photometric Determination of Tin Content in Zinc and Lead.** E. Eberius. *Metall,* v. 12, Aug. 1958, p. 721-724.

6 ref. (S11a; Pb, *Sn,* Zn)

621-S. (Japanese.) **Chemical Analysis and Instrumental Analysis.** Soichiro Musha. *Metals,* v. 28, July 1958, p. 481-487.

Methods of qualitative and quantitative analysis. (S11)

622-S. (Japanese.) **Notes on Chemical Analysis.** Sigeo Wakamatsu. *Metals,* v. 28, July 1958, p. 488-490.

General instructions. (S11)

623-S. (Japanese.) **Choice of Analytical Methods.** Susumu Suzaki. *Metals,* v. 28, July 1958, p. 491-494.

(S11)

624-S. (Japanese.) **X-Ray Fluorescence Analysis.** Jun Shibata. *Metals,* v. 28, July 1958, p. 499-503.

6 ref. (S11p)

625-S. (Russian.) **Separation of Uranium, Vanadium and Iron by Paper Chromatography.** Yu. V. Morachevskii, M. N. Gordeeva and T. E. Kruglova. *Zavodskaya Laboratoriya,* v. 24, no. 7, 1958, p. 790-793.

12 ref. (S11f; Fe, U, V)

626-S. (Russian.) **Use of Ascorbic Acid in Determination of Molybdenum.** A. I. Lazarev and V. I. Lazareva. *Zavodskaya Laboratoriya,* v. 24, no. 7, 1958, p. 798-800.

Volumetric determination of W, Re and Mo. (S11j; Mo, Re, W)

627-S. (Russian.) **Analysis of Pure Metals. Determination of Cadmium in Columbium and Thallium.** V. A. Nazarenko and G. V. Flyantikova. *Zavodskaya Laboratoriya,* v. 24, no. 7, 1958, p. 801-802.

Chemical determination of micro admixtures of Cd in Cb and Tl by the dithizon method after preliminary separation of component elements, using a chloroform solution of 1 ml. 0.002%.
(S11j; *Cd,* Cb, Tl)

628-S. (Russian.) **Determination of Rhenium in Molybdenum-Containing Products.** B. N. Ranskii. *Zavodskaya Laboratoriya,* v. 24, no. 7, 1958, p. 803-804.

(S11; Re, Mo)

629-S. (Russian.) **Volumetric Determination of Thorium by Precipitation of Sodium Benzenesulphonate.** I. P. Alimarin and S. S. Alikberov. *Zavodskaya Laboratoriya,* v. 24, no. 7, 1958, p. 804-807.

5 ref. (S11j; Th)

630-S. (Russian.) **Separation of Cobalt and Zinc by Amalgam Method.** G. N. Babkin. *Zavodskaya Laboratoriya,* v. 24, no. 7, 1958, p. 808-810.

A two-stage amalgam process is used involving filtration through a glass filter under vacuum.
(S11f; Co, Zn)

631-S. (Russian.) **Determination of Intermetallic Phases in Nickel Alloys.** N. M. Popova and A. F. Platonova. *Zavodskaya Laboratoriya,* v. 24, no. 7, 1958, p. 810-812.

Nickel alloys are dissolved by electrolysis in solution of 10 g. citric acid in 10 g. ammonium sulphate in 1200 ml. water under current of 0.06 amp. per sq. cm. and 18-25°. (S11g; Ni)

632-S. (Russian.) **Determination of Iron, Cobalt and Copper in Nickel.** G. V. Loshkareva. *Zavodskaya Laboratoriya,* v. 24, no. 7, 1958, p. 813-814.

(S11a; Co, Cu, Fe, Ni-b)

633-S. (Russian.) **New Spectrographic Instruments Used in Testing Metals.** A. Ya. Khashafyan. *Zavodskaya Laboratoriya,* v. 24, no. 7, 1958, p. 875-880.

Spectrograph with diffraction grid DFC-8; large size spectrograph with diffraction grid DFC-13; spectrograph with direct recording DFC-10 (quantometer type); infra-red double-ray spectrometer IKC-14; photoelectric stylometer FYS-1.
(S11k, 1-53)

634-S. (Russian.) **Role of Graphite Powder in Spectral Analysis and Its Use in Analyzing Highly Pure Antimony.** R. R. Shvangirandze and N. V. Simonova. *Zavodskaya Laboratoriya,* v. 24, no. 7, 1958, p. 881-883.

4 ref. (S11k; Sb, NM-k36)

635-S. (English.) **Tool-Life Testing by Facing in a Lathe.** V. Solaja. *Wear,* v. 1, June 1958, p. 512-514.

It is concluded from experimental cutting with alloy steels using high speed steel tools that the short method of tool-life testing by facing is a promising approximation to Taylor's equation, but more work is needed to clarify uncertainties. Method not applicable to tests with carbide and ceramic tools. 6 ref.
(S21, G17a, T6n; TS)

636-S.* (German.) **Sampling and Determination of Hydrogen Contents in Steel Under Normal Operating Conditions.** Herbert Zitter and Helmut Krainer. *Archiv für das Eisenhüttenwesen,* v. 29, July 1958, p. 401-410.

Apparatus for rapid determination of hydrogen in iron melts. Testing is performed with very low hydrogen loss by means of divided Cu molds or by suction into an evacuated glass tube followed by cooling. The environmental conditions are analyzed and reproducibility criteria are established. 14 ref.
(S11r, 1-53; ST, *H*)

637-S. The Chemical Analysis of Ternary Alloys of Plutonium With Molybdenum and Uranium. G. Phillips, J. Woodhead and E. N. Jenkins. *Analytica Chimica Acta,* v. 19, Sept. 1958, p. 229-234.

6 ref. (S11; Pu, *Mo, U*)

638-S. Determination of Copper, Lead, Tin and Antimony by Controlled-Potential Electrolysis. Pt. 1. General Method of Analysis. B. Alfonsi. *Analytica Chimica Acta,* v. 19, Sept. 1958, p. 276-283.

Controlled-potential electrolysis method by which it is possible to deposit Cu, Pb, Sn and Sb from the same solution in successive stages. Behavior of each metal during deposition; best working conditions. Determinations are not affected by moderate amounts of Ni, Zn, Mn, Fe, Al. 8 ref.
(S11g; Cu, Pb, Sn, Sb)

639-S. Aluminum Identification Simplified. *Steel,* v. 143, Oct. 6, 1958, p. 76-77.

New series of designations applying to stress-relieved Al mill products. Applies only to the heat-treatable series. (S22, S10; Al)

640-S. (German.) **Preparation and Examination of Chemical Analytical Samples.** Alfred Stetter. *Stahl und Eisen,* v. 78, Aug. 7, 1958, p. 1126-1129.

Principles followed in the preparation of check samples to maintain equal chemical composition and physical properties. (S12h)

641-S. Chemical Analysis of Thorium. C. J. Rodden and M. W. Lerner. Paper from "The Metal Thorium", American Society for Metals, 1958, p. 352-370.

Methods for the determination of the following impurities: Al, C, H, Fe, N, O_2, Si, Zr, B, Cd, rare earths, U, Mg, Cr, Cu, Pb, Mn, Mo, Ni, Ti and Zn. 81 ref. (S11; Th)

642-S. The Spectrographic Analysis of Thorium. Velmer A. Fassel and Edward DeKalb. Paper from "The Metal Thorium", American Society for Metals, 1958, p. 371-390.

Carrier distillation technique; conducting briquet technique; determination of the rare earth metals. 14 ref. (S11k; Th)

Metal Products and Parts

399-T. Steel Castings in Airframes. John K. Dietz. Paper from "High Strength Steels for Aircraft", American Society for Metals, 1958, p. 17-20.

Most feasible method of fabricating a complex shape is to cast it to its final configuration. Yet extended application of castings is

being hampered by difficulties currently being encountered. These include low and nonuniform tensile properties; dimensional problems; defects in critical areas; slow delivery. Optimum techniques are recommended. (T24a, 17-57; ST, 5-60)

400-T. Materials for Hypersonic Weapons. J. J. Russ. Paper from "High Strength Steels for Aircraft", American Society for Metals, 1958, p. 31-40.

High-temperature properties of 50 special alloys. Forgeability index numbers, maximum tensile strength, tempering and aging temperatures and maximum usable temperatures are tabulated.
(T24, 17-57, F22, Q-general, 2-62, 17-52)

401-T.* (German.) **Further Development of Lead-Magnesium Bearing Metals.** Hellmuth Seliger. *Freiberger Forschungshefte,* no. B28, 1958, p. 5-20.

Effect of Mg on Pb-bearing alloys. New alloy is superior to known Sn-Pb bearing metals; has greater smoothness, corrosion and heat resistance. Hardening constituents (chiefly Ca and Na) are added to Mg-Pb alloy by electrolytic deposition; properties are improved by heat treatment. (T7d, 17-57; Pb, *Mg*)

402-T. Structural and Vibrational Characteristics of WADC X-1, X-2 and X-3 Model Propeller Blades. J. E. Carpenter, F. W. Stutzman and E. M. Sullivan. Cornell Aeronautical Laboratory, Inc. (Wright Air Development Center.) *U. S. Office of Technical Services,* PB 131239, Jan. 1957, 181 p. $4.75.

Propellers are 5-ft. diameter, three-bladed configurations designed for use in supersonic aircraft. Special test equipment was modified to include a camera installation for photographing the blade tip during rotation. Experimental data included the steady strain distribution at rotational speeds to 5800 rpm. produced by centrifugal force, blade natural frequencies, changes in blade tip pitch angle with rotation, vibratory strain distributions, and blade damping characteristics. Blade vibratory characteristics, in both bending and torsion, were analytically determined. (T24, S21)

403-T. Structural and Vibrational Characteristics of Scale Model Supersonic Propeller Blades. M. O. Burquest and J. E. Carpenter. Cornell Aeronautical Laboratory, Inc. (Wright Air Development Center.) *U. S. Office of Technical Services,* PB 131426, Aug. 1956, 70 p. $2.

Test blades as large as 8 ft. in diameter are instrumented with wire resistance strain gages and rotated in a steel shell evacuated to less than 1% of atmospheric pressure. Test data are obtained at rotational speeds up to 8000 rpm. at any positive or negative blade angle setting. Excellent correlation was obtained between the experimental and analytical results.
(T24, S21)

404-T.* (Japanese.) **Atomic Power and Metals: Beryllium and Its Oxide.** Hiroshi Makatani. *Metals,* v. 28, July 1958, p. 505-507.

Be has remarkable characteristics which are desirable for an atomic pile; small mass, mechanical strength, stability under collision with high energy neutrons, durability, large scattering cross section. Chemical, physical and mechanical properties, deposits in Japanese extraction and refining.
(T11, 17-57, P18; Be)

405-T. Metallurgical Problems in Molten Fluoride Systems. W. D. Manly, J. H. Coobs, J. H. DeVan, D. A. Douglas, H. Inouye, P. Patriarca, T. K. Roche and J. L. Scott. *Second United Nations International Conference on the Peaceful Uses of Atomic Energy,* A/CONF.15/P/1990, U. S. A., June 1958, 30 p.

Use of nickel-base alloys and austenitic stainless steel as construction materials for containing molten fluorides. 7 ref.
(T11, 17-57; Ni-b, SS-e)

406-T. Tool Engineering for the Space Age. T. W. Black. *Tool Engineer,* v. 41, Sept. 1958, p. 73-82.

Space age problems in the aircraft and missile industry and how they are being solved by creative engineering. (T24, G-general)

407-T. A Guide to Nuclear Power. Pt. 3. Metallurgical Problems. W. D. Biggs. *Welder,* v. 27, no. 134, Apr-June 1958, p. 26-29.

Physical properties and types of metals used in construction of various reactor components. Present trend suggests increase in thickness of pressure shell and the use of exotic materials in construction. (To be continued.)
(T11q, K1a, 17-57; SS-e, Cr, Ni)

408-T. Welding Applications at Derby C. & W. Works. Pt. 2. A. E. Bates. *Welder,* v. 27, no. 134, Apr-June 1958, p. 30-34.

Railroad car manufacturer finds welding, where practicable and possible, economical and a very efficient means of fabrication.
(T23p, K1a; ST-b)

409-T. (French.) **Metals for Thermal Reactors.** Marcel Englander. *Mines,* v. 13, no. 2, 1958, p. 167-171.
(T11, 17-57)

410-T. (Italian.) **Selection of Materials for Oil Refining Plants.** *Nickel,* no. 74. June 1958, p. 1-10.
(T29n, R-general, 17-57; Cu-b, Ni-f, ST)

411-T. Rocket Refractories. H. B. Porter. Naval Ordnance Test Station. *U. S. Office of Technical Services,* PB 131503, Aug. 1955, 55 p. $1.50.

Basic refractory substances, including metal oxides, metal-metalloid compounds, and intermetallic compounds, both individually and as ingredients of bonded-ceramic and cermet compositions. Use of refractories as protective coatings, combustion chamber liners and nozzles, with special emphasis on commercial materials. Design and fabrication, physical and chemical properties, manufacturers and products.
(T2p, 17-57; 6-70; RM-h, NM-f)

412-T.* (English.) **Production of Enameled Steel Storage Tanks. Construction of a New Plant With a High Degree of Mechanization.** Jan Holub. *Czechoslovak Heavy Industry,* no. 8, 1958, p. 32-38.

Cost and volume analysis of enamelled steel food storage tanks. New automated plant described.
(T26q, W10a, 17-57; ST, 8-71, 18-74)

413-T.* **Some Metallurgical Aspects of Pontiac V-8 Engine Pearlitic Malleable Iron Crankshaft.** K. B. Valentine. *SAE Transactions,* v. 66, 1958, p. 81-85.

Pearlitic malleable iron is compared with SAE 1046 steel forgings. Modulus of elasticity is less; however, torsional vibration characteristics are similar. Fatigue, hardness and wear properties are satisfactory. Machinability is much better than that of SAE 1046.
(T21b, 17-57, Q-general; CI-s)

414-T.* **Problems in the Application of High-Strength Steel Alloys in the Design of Supersonic Aircraft.** A. F. Ensrud. *SAE Transactions,* v. 66, 1958, p. 118-136.

Ways to alleviate the intrinsic weight penalties accompanying the use of high-density alloys at elevated temperatures. Primarily, this can be accomplished by the proper selection of materials and the choice of more suitable structural configurations. 16 ref.
(T24, 17-57, 2-62; AY, SGB-a)

415-T.* **The Nonnuclear Application of Thorium.** W. C. Lilliendahl. Paper from "The Metal Thorium", American Society for Metals, 1958, p. 20-28.

Th metal is utilized as a deoxidant (as for Mo and Fe) and in electronic tubes and lamps for controlling starting voltages and maintaining stability over useful life. An expanding field is the use of Th in W electrodes for heliarc welding where it provides an instant starting arc and arc stability. Th has also found application in the production of sound ductile joints in Mo. 19 ref. (T1j, W29h, 17-57; Th)

416-T. Ways to Keep Fasteners Locked. Federico Strasser. *Iron Age,* v. 182, Sept. 25, 1958, p. 88-91.
(T7f)

417-T. Modern Cutting Tools Save Costs at High and Low Speeds. H. J. Siekman. *Iron Age,* v. 182, Sept. 18, 1958, p. 95-97.
(T6n, 17-57; SGA-j, 6-20, 17-53)

418-T. Foil Clad Laminates in Printed Circuitry. D. K. Rider. *Metal Progress,* v. 74, Sept. 1958, p. 81-85.

Start with an insulating base, glue on very thin Cu foil (free of holes or inclusions) etch away unwanted areas leaving behind conductive paths from point to point. This concept leads to rugged assemblies, mass produced at minimum cost. (T1c; Cu, 4-56)

419-T. Four-Story Welded Frame Designed by the Plastic Theory. M. R. Horne. *Welding and Metal Fabrication,* v. 26, Aug. 1958, p. 278-280.
(T26n; ST, 17-51)

420-T. (Russian.) **Role of Iron and Steel Castings in Machine Building.** F. Naumann. *Liteinoe Proizvodstvo,* July 1958, p. 30-32.
(T-general, 17-57; CI, ST)

421-T. (Book.) **High Strength Steels for Aircraft.** 81 p. 1958. American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio. $2.95.

Papers presented at the first Southwestern Metal Congress, Dallas, Tex., May 12-16, 1958. Papers abstracted separately. (T24; ST)

Plant Equipment

450-W.* **Calculation of Cooling Characteristics of Barstock on Cooling Beds and the Suitability of Certain Cooling Bed Designs for Material of**

Different Compositions and Profiles. Paul Grüner. *Draht (English Edition)*, no. 35, June 1958, p. 19-26.

Principal purposes and functions of cooling beds. Drives and designs of various cooling bed units, including inlet roller conveyor, transverse feeder, rod aligner, transfer unit, mechanical rake, Morgan, Edwards, roller-type and rotating type cooling beds. (To be concluded.) (W23p, F27, 1-52; ST)

451-W.* (Spanish.) Deep Penetration Electrodes. Celso Penche. *Ciencia y Tecnica de la Soldadura*, v. 8, May-June, 1958, 14 p.

History; types, techniques of use; technological and economic advantages; structural, metallurgical behavior and mechanical properties of welds obtained on various steels; applications. (W29h, K1)

452-W.* Light Section Rolling Mills. Stanislav Makrlik. *Czechoslovak Heavy Industry*, June 1958, p. 25-31.

Three typical examples of rolling mill designs. Metallurgical plants supplying the technical particulars and requirements, so the supplier can design a mill based on technical and economic analysis. (W23, 17-51)

453-W.* Mercury-Arc Converters for Induction Heating. T. A. Cosh. *Foundry Trade Journal*, v. 105, Sept. 4, 1958, p. 291-294.

Application of grid control to mercury-arc rectifiers as sources for high-frequency electric supplies in relation to their application to melting furnaces. (W18a, E-general)

454-W.* (German.) Test with Zirconium Silicate Linings in Arc Furnace Covers. Alfred Theis. *Stahl und Eisen*, v. 78, June 26, 1958, p. 891-892.

A lining based on zirconium-cristobalite proved successful for covers of arc furnaces subjected to severe wear. A prerequisite is adequate cooling of the cover to prevent distortion. The additional life of lining (up to 126 heats) and savings in brickwork offset in many cases the higher cost of the lining material. Small heat expansion and high resistance to fire pressure are the main characteristics in comparison to conventional silicate linings. (W18s; RM-h)

455-W.* (Polish.) Flame, Gas-Fired Furnace With Heat Recuperation for Pig Iron Melting. Gabriel Kniaginin and Roman Andrzejewski. *Hutnik*, v. 25, May 1958, p. 165-171.

Furnace of 25 tons capacity. Process of pig iron melting. Heat balance of the furnace. Suggested improvements. 8 ref. (W19a; CI-a)

456-W.* (Russian.) Hard Metal Reinforced Punching Dies. S. S. Chetverikov and N. K. Foteev. *Vestnik Mashinostroeniya*, v. 38, Aug. 1958, p. 38-40.

Experiments for determining most effective metallo-ceramic alloys for reinforcing dies utilized transformer sheet steel, 0.5 mm. thick, of composition 0.1% C, 4.2% Si, 0.1-0.2% Mn, 0.025% P and 0.035% S. Alloys of medium grain size are most effective. Reinforced punching dies of above steel are ten times more durable than those using tool steel, and operate with much greater precision. (W24n, 17-57; ST, Si, 4-53, 6-70)

457-W. Applying Carbides to Drawing Steel Casings. *Carbide Engineering*, v. 10, Sept. 1958, p. 22.

Use of carbide dies for drawing 7-in. oil well casings at Pittsburgh Steel Co.'s Allenport Works saves money over steel dies. (W24n; 6-69)

458-W. Rolling Mills. Vaclav Matousek. *Czechoslovak Heavy Industry*, June 1958, p. 20-25.

Czech rolling mill equipment. (W23c, 18-67; ST)

459-W. Machinery Equipment for Rolling Mills of Non-Ferrous and Light Metal Sheets, Plates and Strips. Vladimir Sipek. *Czechoslovak Heavy Industry*, June 1958, p. 32-46.

(W23c, F23q, 1-52, 18-67; Al, Zn, Cu)

460-W. Recent Development in Industrial Furnaces. *Draht (English Edition)*, no. 35, June 1958, p. 40-42. (W27)

461-W. Automatic Lathes for the Production of Nuts and Screws. Heinz Petrick. *Draht (English Edition)*, no. 35, June 1958, p. 42-46.

(W25n, T7f)

462-W. Future of Low Shaft Furnaces in India. M. N. Dastur and R. D. Lalkaka. *Indian Institute of Metals, Transactions*, v. 9, 1955-1956, p. 59-82.

Operating features of two representative types of low-shaft furnace processes for the production of iron from inferior raw materials—the Calbe type and DHN type. 6 ref. (W17h, 1-52)

463-W. The Rolling Mill Plant of the I.C.C. Ltd at the Moubhandar Works, Ghatsila. D. Singh. *Indian Institute of Metals, Transactions*, v. 9, 1955-1956, p. 263-274.

Equipment and layout. (W23, 18-67)

464-W. How to Design Conveyor Rolls for Drive or Drag. Laurence H. Austin. *Product Engineering*, v. 29, Sept. 15, 1958, p. 78-79.

Pinch and bridle rolls, grouping of rolls for desired effect; power calculations. (W23c, 17-51, F23)

465-W. The Significance of Velindre Works. A Technical Survey of the Velindre Works of the Steel Co. of Wales Ltd. H. Leighton Davies. *Sheet Metal Industries*, Technical Survey no. 6, 1958, 96 p.

Installation of new mill for rolling, tinplating of strip steel. A 5-stand mill has capacity of over 400 tons per shift. (W23c, L16; ST, *Sn*)

466-W. Steel Plant Installs Cupolas. *Steel*, v. 143, Sept. 29, 1958, p. 94-97.

Cupolas with high top-pressure, hot blast, split wind blowing, furnish hot metal for oxygen converters in new plant. (W18; ST)

467-W. Magnetic Test Accurately Compares Heat Extraction Properties of Quenching Media. Edward A. Bender and Harry J. Gilliland. *Tooling and Production*, v. 24, Sept. 1958, p. 55-58.

Test measures time required for a medium to cool a metal to its Curie point, where it then regains the magnetic properties which it lost through superheating. The equipment also can be used to investigate the heat extraction properties of other substances, such as cutting fluids. (W28p, 1-54; NM-h)

468-W. (Czech.) Modern Regulation Technique of Rolling Mill Drives. Jan Soukenik. *Hutnické Listy*, v. 13, no. 7, 1958, p. 620-625.

Properties of principal types of drive motors and corresponding regulating equipment. (W23n)

469-W.* (German.) Mechanization of a Gray-Iron Foundry. Hans Krause. *Giessereitechnik*, v. 4, July 1958, p. 145-153.

Different sands are transported into large containers that discharge in the right proportion to a sand mixer. Old sand, coal dust and water are added and the mixture is fed to a sandslinger. (W19h, 18-74; CI-n)

470-W. (Russian.) Centralized Production of Tools for Tube Rolling Mills. Yu. I. Nikolaevskii and M. Ya. Krichevskii. *Stal'*, v. 18, July 1958, p. 633-635.

Expanding needs of Soviet metallurgical industry calls for plants which specialize in production as well as repair, heat treatment and testing of tube mill tools and equipment. (W23h, F26s; ST)

471-W. (Russian.) Casting of Ingot Molds of Nodular Iron. G. A. Pisarenko, S. G. Guterman and Ya. I. Aizikovich. *Stal'*, v. 18, July 1958, p. 668-672.

The stability of ingot molds cast in permanent molds is considerably lower than those made in sand molds. The stability of nodular iron ingot molds, modified with 75% ferro-silicon during pouring into chill molds, is generally higher than that of cast iron molded in semipermanent sand molds. (W19c, 17-57, E23; CI-r)

472-W. (Russian.) Development of Forge Extrusion Plant. V. A. Massen. *Vestnik Mashinostroeniya*, v. 38, Aug. 1958, p. 32-38.

(W22, F24, 1-52)

473-W.* The Philosophy of Soaking Pits. W. Trinks. *Industrial Heating*, v. 25, Sept. 1958, p. 1732, 1734.

History and development of soaking pits and pit furnaces. Relationships between track-time and heating time, and total hearth area to monthly throughput. (W20g)

474-W.* Cast and Rammed Sections in Electric-Arc Furnace Roofs. J. D. McCullough. *Industrial Heating*, v. 25, Sept. 1958, p. 1825-1826, 1828, 1830, 1832, 1834, 1836, 1840, 1845.

Study of roof life for arc furnaces employing monolithic constructions is presented by obtaining furnace roof life at different plants producing different types of steel, and with different operating practice. (To be continued.) (W18s; RM-h)

475-W.* The Craft of Spray Painting. Leonard Gaiger. *Product Finishing*, v. 11, Sept. 1958, p. 74-79.

Description of spray gun, technique and maintenance. (W4g, L26n)

476-W.* The Electronically Controlled Semi-Automatic Spray System. John Webb. *Product Finishing*, v. 11, Sept. 1958, p. 81-85.

Semi-automatic paint spray methods, horizontal traverser, semi-automatic single turntable, electronically controlled spray auto, accessories for batch finishing and spindle conveyor with spray equipment. (W3d, W4g, L26n; 18-74)

477-W.* (Czech.) Materials for the Jaws of Flash-Butt Welding Machines. René Rohan. *Zvaranie*, v. 7, Aug. 1958, p. 227-234.

Cast jaws of 85-87% Cu, 13-15% Sn, 1% max. Pb, 0.2% max. Fe, 0.2% max. Mn, 0.5% max. Zn are subject to rather fast wear in auto-

mobile wheel production. New jaw materials were tested and best results were obtained with "Cu-Ni2-Si (= CSN 423054)" when hardened at 750-780° C. for 2 hr. in oil and tempered at 500° C. for 4 hr. in air. Its composition: 2.28% Ni, 0.52% Si, 0.07% Fe, 0.01% Al, 96.7% Cu. (W29k, 17-57, W3r; Cu-b)

478-W.* Filler Metal for Joining. Orville T. Barnett. *Welding Engineer*, v. 43, Oct. 1958, p. 48-50.

Tungsten electrodes (pure W, thoriated W and Zr-W) used in Tig welding, including chemical analysis and welding properties. Comparison of commercial Tig welding electrodes. (W29h, 17-57; W, SGA-f)

479-W. Automatic Batch Furnace Cuts Costs. *Canadian Metalworking*, v. 21, Sept. 1958, p. 20, 22, 24.
(W27g; 1-62, 18-74)

480-W. 150-Ton Electric Arc Furnace. Gaston Stassin. *Iron and Coal Trades Review*, v. 177, Aug. 15, 1958, p. 379-381.

Operating practice at S.A. Fabrique de Fer, Charleroi.
(W18s, D5, ST)

481-W. Mill Gearing as Viewed by a Lubrication Engineer. A. E. Cichelli. *Iron and Steel Engineer*, v. 35, Sept. 1958, p. 91-102.

Problems relating to mill drives, types of rolling mills, lubrication, gear design theory. 6 ref.
(W23, T7a; NM-h)

482-W. Bend and Weld Cabinets Automatically. R. F. Hermann. *Metalworking Production*, v. 102, Sept. 19, 1958, p. 1650-1653.

Introduction of a four-station integrated line of automatic sheet-feeding equipment, piercing, notching and embossing presses, tangent and flange benders, from which the formed cabinets are passed to a similarly automated welding line. (W12, W29, G3p, G6, K3p, 18-74)

483-W. Facing Girders Is Outsize Milling Job. *Metalworking Production*, v. 102, Sept. 19, 1958, p. 1654-1655.

Ends of large weld-fabricated structural girders, regardless of size, can be machined by new rigid milling machine. (W25r; G17b)

484-W. A Survey of General and Specialized Machine Tools for Press-Tool Production. J. A. Waller. *Sheet Metal Industries*, v. 35, Sept. 1958, p. 699-704.
(W25)

485-W. Tool Vibration Is Cut 75%. *Steel*, v. 143, Oct. 6, 1958, p. 78.

Shanks for holding carbide cutting tools made from powdered metals have lower cost, increase tool life, produce improved surface finish. (W25d, 17-57; 6-72)

486-W. (German.) **Two Kinds of Gas Turbines Used in Belgian Steel Mills.** André Jaumotte. *Stahl und Eisen*, v. 78, May 15, 1958, p. 658-663.

Two kinds of gas turbines operating on blast furnace gas; characteristics and efficiency as well as maintenance probems. Lower dust contents in gas recommended for increased efficiency.
(W11n, W17g, 17-52, RM-m39)

487-W. (German.) **Novel Oil-Firing Plant for Openhearth Furnaces.** Wolfgang Schleicher and Kurt Boleg. *Stahl und Eisen*, v. 78, Aug. 7, 1958, p. 1108-1109.

By the use of compressed waste gas, the fuel oil is conveyed as well as preheated and atomized.
(W18r, W16; RM-k)

488-W. (Russian.) **Modernizing Resistance Melting Furnaces.** V. E. Antonov and D. Z. Sterlin. *Liteinoe Proizvodstvo*, July 1958, p. 11-13.

Furnace for melting aluminum alloys in piston plant has capacity of 416 kvt., and 5 different heat zones. It turns out 700 kg. per hr. Operating temperature is 850°.
(W18, 1-52; Al-b)

489-W. (Russian.) **Ventilation of Blast Furnace Hot Blast Stove Buildings.** P. V. Sidyakov, M. Ya. Zarzhevskii and G. F. Ermolaeva. *Stal'*, v. 18, Aug. 1958, p. 691-693.

For effective ventilation of hot blast stove buildings and their working platforms it is recommended that use be made of the air vents installed between the hot blast stoves, which should be equipped with windscreens. The temperature drop between the outgoing air and the outdoor temperature should be maintained at 10° C.
(W10d, W17g; ST)

490-W. (Russian.) **Instrument for Continuous Control of Metal Pressure on Rolls.** I. M. Meerovich. *Stal'*, v. 18, Aug. 1958, p. 718-721.

Makes it possible to determine the optimum metal reduction conditions and to increase output of rolling mill without damaging any of its parts. (W23, X12)

491-W. (Russian.) **Modernization of Recuperative Soaking Pits With a Central Burner.** V. G. Kaplan, S. D. Gekhtman and L. G. Aksel'rud. *Stal'*, v. 18, Aug. 1958, p. 747-751.

By increasing the surface heating and setting up a method for heating gas with a centralized burner considerable fuel economy has resulted in use of blast furnace gases as main source of fuel.
(W20g, RM-m39)

492-W. (Russian.) **Automation of Water Supply at Iron and Steel Mills.** M. P. Suslov. *Stal'*, v. 18, Aug. 1958, p. 759-763.
(W10h, 18-74; ST)

493-W. (Russian.) **Performance of Coupling Sleeves of Nodular Cast Iron in Rolling Mills.** E. K. Turchenkova, A. I. Sikorskii and R. M. Egnus. *Stal'*, v. 18, Aug. 1958, p. 763-766.
(W23p, T7, 17-57; CI-r)

494-W.* (Book.) **Gas Turbine Materials.** G. Lucas and J. F. Pollock. 163 p. 1957. Temple Press Ltd., Bowling Green Lane, London, England. 25 sh.

Historical development of high-temperature alloys. Creep and fatigue properties and corrosion resistance necessary to withstand high-temperature stress and oxidative conditions in gas turbine engines. Selection of engine material and applications of specific alloy type in compressor, combustion chamber, turbine disk, rotor assembly, turbine blading and heat exchangers. High-temperature properties and composition of commercial high-temperature alloys. Manufacture of turbine components.
(W11m, 17-57, Q-general; SGA-h)

Instrumentation

Laboratory and Control Equipment

84-X. An Eddy Current Thickness Tester for Copper Plated on Uranium. Arthur P. Holt and Louis H. Cook. *U. S. Atomic Energy Commission DP-252*, 1958, 11 p. (Available from U. S. Office of Technical Services, Washington 25, D. C.)

Instrument measures thickness by the eddy current principle and is usable in the range of 0.004 to 0.012 in. with an accuracy of 5%. With minor modifications and adjustments the instrument may also be used to measure thicknesses as great as 0.035 in., of either Cu or Al, on any substrate whose specific resistivity approximates that of U.
(X20c, 1-69; Cu, U, 8-62)

85-X. State of Development of Thermal Radiometer. A. Pfenninger, H. E. Henry, M. Godet and C. A. Wogrin. Quantum Inc. (Wright Air Development Center.) *U. S. Office of Technical Services*, PB 131746, Mar. 1958, 57 p. $1.50.

Design and manufacture of the components of a thermal radiometer; mathematical analyses of heat transfer and control system problems. Forming a cone by electroforming technique. Adhesives of epoxy resins filled with Al powder developed to bond wires onto the system's Cu sink.
(X2, 17-57, L18, K12)

86-X Electrical Strain Measurements at High Temperatures. James E. Starr. Paper from "Sheet Materials for High-Temperature Service", American Society for Metals, 1958, p. 37-50.

Three most important characteristics of resistance material for precision resistor application are temperature coefficient of resistance stability and high resistivity. Stability of several well-known strain gage alloys. (X28j, 17-57)

87-X. (Russian.) **Extensometer for Measuring Static Deformation at Temperature of 450°.** E. Yu. Nekhendzi and N. G. Tisenko. *Zavodskaya Laboratoriya*, v. 24, no. 7, 1958, p. 872-874.

3 ref. (X29p)

88-X. (Russian.) **Device for Electropolishing and Etching Metallographic Microsections.** L. Ya. Popilov. *Zavodskaya Laboratoriya*, v. 24, no. 7, 1958, p. 890-892.

(X4e, X4f)

89-X.* Experimental Approaches to Radiation Effects. J. C. Wilson. Paper from "Effects of Radiation on Materials", 1958, Reinhold Publishing Corporation, p. 48-98.

Factors involved and difficulties encountered in designing and performing experiments to measure radiation effects. Reactors as source of radiation. Experimental facilities in available research and test reactors. Mechanical and safety considerations and experiment design. 96 ref. (X2, 1-53, 2-67)

90-X.* The Care of Platinum Thermocouples. H. E. Bennett. *Platinum Metals Review*, v. 2, Oct. 1958, p. 120-123.

Precautionary methods to extend thermocouple life; effect of prolonged heating; contamination; embrittlement, creep test data; in-service failure. (X9q, 17-57; Pt)

91-X. (Russian.) **Torque and Pressure Measuring Instruments.** V. I. Petrikeev. *Stal'*, v. 18, Aug. 1958, p. 728-729.

(X29, X12)

(*)Articles Available Through Photocopy Service; See Coupon, p. 75.

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The Employment Service Bureau is operated as a service to members of the American Society for Metals and no charge is made for advertising insertions. The "Positions Wanted" column, however, is restricted to members in good standing of the A.S.M. Ads are limited to 50 words and only one insertion of any one ad. Address answers: c/o A.S.M., 7301 Euclid Ave., Cleveland 3, O., unless otherwise stated.

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METALLURGIST: Bearing company has opening for graduate metallurgist. Age 25 to 35 with minimum of three years industrial experience in wrought ferrous alloys. Thorough training in laboratory, mechanical testing, metallography, failure analysis, heat treating, specifications and technical reports necessary. Box 11-5.

PLANT MANAGER AND ENGINEER: To take complete charge of heat treating operation in fast growing company with good reputation. Must be familiar with atmospheres, induction hardening, toolsteels and production work. Must be able to train personnel. Good salary, opportunity for advancement. Box 11-10.

METALLURGICAL ENGINEER: To work under metallurgical engineer in central development and research on problems pertaining to foundry, machine shop and welding. Will assist central research vice-president in charge of metallurgical development and research engineering. B.S. degree required, M.S. degree preferred. Minimum of three years experience in above work. Not under 30 Salary $650 per month. Box 11-15.

METALLURGICAL ENGINEER: To work in research development on projects pertaining to elevated temperature, heat, corrosion and special analysis on steel castings. Able to follow through and direct research projects. Minimum of B.S. degree, M.S. preferred. Not under 27. Salary $550 per month. Box 11-20.

RESEARCH: Metallurgist for research and development department. Degree required, with two to five years experience, preferably in reactive or refractory metals. Send resume covering education, experience and salary requirements to: R. D. Crissman, Universal-Cyclops Steel Corp., Bridgeville, Pa.

VACUUM MELTING: Opportunity in Western Pennsylvania for assistant melting superintendent. Minimum experience five years, degree preferred. Send resume covering education, experience, salary requirement and availability for interview. Box 11-25.

FERROUS PROCESS AND PHYSICAL METALLURGISTS: With one to five years experience in iron and steel industry, to work with expanding research and development organization in large and extremely diversified steel producing facility. Openings are available for metallurgical engineers familiar with and having a working knowledge of blast furnace, sintering plant, various steel producing processes, rolling mills and product physical metallurgy. B.S. degree required. If you desire a challenging assignment with an opportunity for professional growth and advancement, send complete resume. Box 11-30.

OPENING: For person experienced in manufacture of tungsten carbide. This is a new position and one in which a person who desires to get ahead will find fullfillment of his opportunity. Prefer someone with foreman experience and engineering, with degree, but this is not positive requisite if experience is sufficient. Salary open and company will pay moving expenses. All replies held in strict confidence. Box 11-125.

METALLURGIST: Young, for testing glass fibers and laminates and to take charge of this phase of research programs. Laboratory in Western Pennsylvania. Indicate education, experience. References required. Furnish telephone number. Box 11-130.

WANTED—METALLURGIST capable of developing complete line of stainless steel electrodes and wires. Salary open. Write Stoody Co., Box 901, Whittier, Calif.

East

LIAISON AND QUALITY CONTROL ENGINEER—FOUNDRY: For international manufacturer of mining and construction equipment located in resort area of west central New Hampshire. Under foundry superintendent, responsible for liaison with customers and other Joy plants, and for developing and maintaining a quality control program. At least five years experience in steel foundry work with knowledge of metallurgy, foundry practices and quality control. Requires degree in metallurgy, or in chemistry or physics with metallurgical experience. Send resume and salary requirements to: Personnel Manager, Joy Manufacturing Co., Claremont, N. H.

METALLURGICAL ENGINEER: To work with design and development engineers. Must know specifications, materials (ultra-high-strength, high-temperature and high-speed tool-steel grades), heat treating and manufacturing procedures. Investigate failures and write reports. B.S. degree with five to seven years experience required. Send resume. Box 11-35.

CUSTOMER SERVICE METALLURGIST: Flat rolled products. Production and some customer service experience desired. Work with plant metallurgists and salesmen to provide technical assistance to strip, sheet and plate customers. We are a fully integrated plant adjacent to top residental areas of suburban Philadelphia. Submit resume in confidence to: J. A. Glunt, Chief Metallurgist, Alan Wood Steel Co., Conshohocken, Pa.

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West

METALLURGIST: Major aircraft and missile manufacturer has attractive opportunities in

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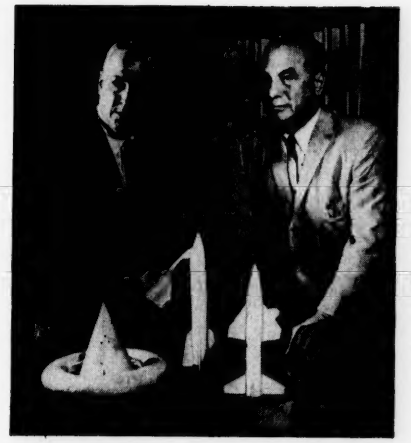
An invitation to senior scientists and engineers



A $14,000,000 R & D Center, housing 9 new laboratories, was revealed as core of Republic's $35,000,000 Research and Development Program at recent announcement by Mundy I. Peale, President, and Alexander Kartveli, Vice-President for Research and Development.

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"...VERTICAL TAKE-OFF FIGHTER-BOMBERS, HIGH-MACH FIGHTER-BOMBERS, AND SUPERSONIC TRANSPORTS."

Alexander Kartveli, Vice-President for Research and Development, emphasized that Republic's program "will not duplicate in any way investigatory work currently in progress elsewhere, but will stress novel concepts and new approaches to basic problems of missiles and space technology."

The program includes construction of a $14 million R & D center to house 9 new laboratories, and anticipates doubling the present research staff.

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MATERIALS DEVELOPMENT LABORATORY
Study effects of high velocity, temperature, and space environment on materials for spacecraft, missiles and advanced weapons.

GUIDANCE & CONTROL SYSTEM DEVELOPMENT LABORATORY
To develop and test guidance and control systems for spacecraft, missiles and aircraft.

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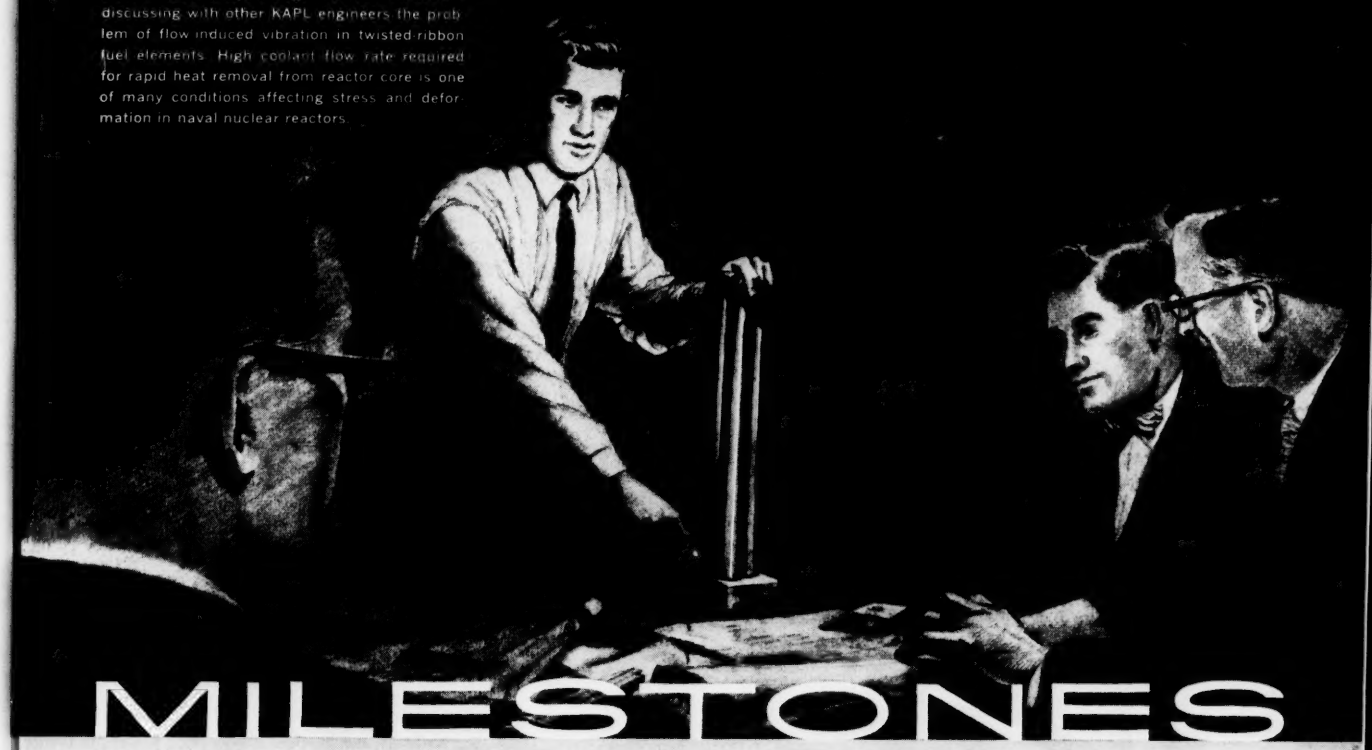

KAPL Stress Analysis Engineer Eric Johansson, discussing with other KAPL engineers the problem of flow induced vibration in twisted-ribbon fuel elements. High coolant flow rate required for rapid heat removal from reactor core is one of many conditions affecting stress and deformation in naval nuclear reactors.

MILESTONES IN REACTOR TECHNOLOGY

at The Knolls Atomic Power Laboratory... in Stress Analysis

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PROFESSIONAL OPPORTUNITIES

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U.S. Citizenship required; advanced degree and/or related experience preferred. Inquiries may be made in confidence by submitting resume and salary requirement to: Mr. A. J. Scipione, Dept. 41-MW

Eric B. Johansson is one of approximately twenty Stress Analysis Engineers working on naval reactors at KAPL. Eric joined G.E. in 1951 following graduation from the California Institute of Technology and graduate study at UCLA. He has completed advanced study in engineering analysis as a graduate of G.E.'s Advanced Engineering Program and has taken additional graduate work at Rensselaer Institute of Technology under G.E.'s Tuition Refund Program.

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ARE YOU OVERLOOKING SOME OF THE MOST CRITICAL CHALLENGES IN THE MATERIALS FIELD?

Listen in on this interview with Dr. A. E. Focke, Manager Materials Development at General Electric's Aircraft Nuclear Propulsion Dept., Cincinnati, Ohio

Q. ***Dr. Focke, I have heard it said that the Aircraft Nuclear Propulsion Program adds a new dimension to materials technology. Do you agree?***

A. Strictly speaking, Mr. Walsh, reactor development for any application may be said to do this, since materials must be selected for their nuclear as well as their physical properties.

For some applications we look for high neutron absorption cross sections; for others, low capture cross sections.

For example, the material selected for the *moderator* must be capable of slowing down the neutrons produced by fission to thermal energy, about 1/40 ev from their original energy of several million ev with a minimum loss of neutrons by parasitic capture. *Control rods* on the other hand, must have high capture cross section for neutrons.

In practically all material applications for the nuclear power plant for aircraft which we are developing here, however, we have a high temperature problem of dimensions unique in materials technology.

Q. ***Why is that, Dr. Focke? Aren't these problems similar to those already solved for marine nuclear propulsion?***

A. In the ANP program weight and size are severely limiting factors. Here we are dealing with a small, high density reactor a small fraction of the size and weight of the submarine reactor. To jam high energy into small volume requires the development of high temperatures. Generally the higher the reactor exit-air temperature, the better the overall performance of the power plant.

The crux of the problem here is the fact that common materials desired for some parts of the reactor for nuclear considerations, cannot operate at the maximum temperature of the over-all system.

These charts, prepared for a recent paper will give you a better conception of the materials problem. Fig. 1 summarizes the general requirements. Figs. 2, 3 and 4 review a few of the basic physical properties of each of 11 metals selected for discussion.

Q. ***Can a materials man work effectively at ANP without previous training in nucleonics?***

A. Certainly. All the orthodox skills of the metallurgist, ceramist or chemical engineer are called into play here. The Aircraft Nuclear Propulsion Department will provide necessary training and information in nucleonics.

Q. ***What you've just told me, Dr. Focke, I certainly can discern the challenge to the materials man that you have here. I suppose you are working with alloys of some of the more exotic metals so much discussed in the latest technical literature?***

A. Security limitations forbid my naming specific materials on which we are concentrating our investigations at this time. We have, however, made considerable progress, though a great deal of work remains to be done before our first high performance nuclear power aircraft makes its maiden flight.

One of our principal problems is to be sure we have people with the required technical competence and specific abilities to function effectively.

Component	High Strength At High Temp.	Ability to Resist Oxidation	Neutron Absorption Cross Section	Density	Special Requirements
Fuel Elements	x	x	Low	--	Compatibility with fuel.
Moderator	x	x	Low	Low	Ability to slow neutrons to thermal effectively.
Control	x	x	High	--	
Shield					
a. Gamma	x	x	--	High(1)	(1)Ability to attenuate γ.
b. Neutron	x	x	High(2)	Low	(2)Ability to absorb without producing γ.

FIG. 1

Some characteristics of 11 metals in relation to possible application in Nuclear Power Plant for Aircraft — prepared by Dr. A. E. Focke, Manager, Materials Development.

Thermal Neutron Absorption Cross Section In Barns		Melting Point-°F	
1. Hf	105.0	1. W	6116
2. Re	84.0	2. Re	5756
3. Ta	21.3	3. Ta	5426
4. W	19.2	4. Mo	4752
5. U	7.68	5. Cb	4474
6. Th	7.4	6. Hf	4032
7. Ti	5.6	7. V	3452
8. V	5.1	8. Zr	3375
9. Mo	2.5	9. Th	3308
10. Cb	1.1	10. Ti	3020
11. Zr	0.18	11. U	2071

FIG. 2 FIG. 3

Crystal Structure		Allotropic Transformation
1. Re	h.c.p.	NONE (known)
2. Hf	h.c.p.	b.c.c. 3020°F
3. Ti	h.c.p.	b.c.c. 1620°F
4. Zr	h.c.p.	b.c.c. 1584°F
5. Th	f.c.c.	b.c.c. 2426°F
6. W	b.c.c.	NONE
7. Ta	b.c.c.	NONE (known)
8. Mo	b.c.c.	NONE
9. Cb	b.c.c.	NONE
10. V	b.c.c.	NONE
11. U	ortho	tetra 1220°F; b.c.c. 1427°F

FIG. 4

Metallurgists, ceramists, physical chemists, solid state physicists with background in hi-temperature materials are invited to inquire about professional opportunities in these areas. Nuclear experience, while desirable, is not essential.

Write in confidence including salary requirements to: Mr. P. W. Christos, Professional & Technical Personnel — Division 41-MW

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